MAY, 1942

ORGANIC FINISHING

SECTION OF METAL FINISHING

CQUERING • ENAMELING • JAPANNING • PAINTING

Idle Drums Delay Deliveries

Keep them rolling back to Zapon

Do you realize that there are 25 square feet of steel in a 50 gallon drum? That means a lot of metal, critical in the war effort, is immobilized on junk-piles, in store rooms, wherever drums lie idle. It means deliveries are delayed. Remember the government has allowed re-use of "non-returnable" drums and pails.

So please dig out idle drums and steel pails—get them rolling back to us. And send them back in good shape—otherwise they're not much good. That means, replace plugs and covers, when empty; don't lose lugs; bend lugs all the way around when removing covers; don't batter or dent the containers, keep them out of the elements.

Look around the plant now. You'll be helping the war effort and yourself, as well as assisting us to keep deliveries going. Unless you do your part, we can't fully conserve metal needed for war.

ZAPON

REG. U. S. PAT. OFF.

ZAPON DIVISION · ATLAS POWDER COMPANY

Eastern Sales: Stamford, Conn. *Western Sales:* North Chicago, Ill.

INDUSTRIAL FINISHES

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Finish Control and the War

For many years we of the editorial staff have been keenly interested in the control of organic finishing materials and finishing procedures. It has been our firm conviction that good finishing can not be accomplished by using hit-or-miss rule-of-thumb methods. Over a period of time, therefore, we have devoted considerable editorial space to the various phases of the subject and have made a special effort to secure and present articles of value and interest on control work to our readers.

We believe that there is a greater need for control in finishing than ever before. The objectives of controlled finishing—greater economy, faster production, better quality—are the same today as they were in times of peace but they are of far more importance. We are now interested in the increased economy which results from controlled finishing because we wish to save materials, to make each gallon of lacquer or paint or varnish go farther, to conserve precious raw materials. We desire faster production on finishing lines so that we may supply our war needs quickly and with a minimum of labor and equipment required per unit finished. We wish finishes of higher quality in order that our war equipment, machine tools as well as tanks and guns, may be well protected and thus continue to function although subjected to conditions which tend to cause deterioration and breakdown.

We sincerely hope that our efforts in the past have been helpful in bringing useful information on controlled finishing to our readers. We will continue to attempt to be of help not only in presenting new articles on the subject but also through our staff of experts who are ready to give every possible aid to readers who have individual problems.

L. H. LANGDON, *Publisher* • T. A. TRUMBOUR, *Business Manager* • DR. WALTER R. MEYER, *Editor*

NOTICE – IMPORTANT

Use Old Shipments of Finishing Materials First

Finishing materials may deteriorate on long storage. Date all containers of finishing materials on delivery and do not draw from a new shipment until all previous lots have been used.

—::—

Store Finishing Materials Properly

Extremes of heat or cold may harm finishing materials. Maintain a temperature of at least sixty degrees Fahrenheit in paint storage rooms but do not expose materials to the direct heat of steam radiators, etc. Allow all finishing materials to come to room temperature before using.

—::—

Mix Finishing Materials Thoroughly Before Thinning

Incomplete mixing is often the cause of finish troubles such as streaky color, poor hiding, variable gloss, etc. Mix all finishing materials thoroughly before adding thinners, especially pigmented materials in which settling may have occurred.

—::—

Thin Finishing Materials Properly

Many finishing difficulties result from the use of improper thinners or from adding thinners incorrectly. In all cases use the thinner recommended by the manufacturer of the finishing material. Add thinners slowly and in small amounts, making certain that each addition is stirred in thoroughly.

—::—

Do Not Waste Finishing Materials or Thinners

To waste finishing materials or thinners is to waste valuable resins, pigments, solvents, etc. Prepare only enough material for one day's use. Do not spill finishing materials. Cover all containers tightly to prevent skinning and evaporation of volatile thinners. Completely empty all containers.

—::—

Maintain Good Housekeeping

A dirty shop is neither pleasant, efficient nor safe. Clean up all spilled material. Keep equipment clean and in good operating order. Employ scrap cans. Keep work arranged in orderly fashion.

Editor's Note: At the suggestion of some of our readers, the above sign for use in finishing departments has been prepared. It is hoped that the sign, conspicuously placed, will serve to remind all those engaged in finishing that the right way in finishing is the right way for the finishing industry to aid in our war effort.

Finishing Air Compressors

Bottleneck Eliminated by Installing No-Enclosure Paint Spraying Area

IN order to overcome a bottleneck in the production of both small and heavy engine and air compressor assemblies, each type requiring its own individual color finish, LeRoi Company installed at their Milwaukee, Wisconsin plant a down-draft exhaust system, using no enclosure whatever. The company manufactures gas and butane engines, portable air compressors, and engine-generator sets. Some of the smaller units are handled aboard skids by means of lift-trucks, while the heavier assemblies are placed in the spraying area by an overhead traveling crane.

Castings of engine bases and other parts, as well as forgings of crank shafts, connecting rods, steel bumpers (used in compressor valve assemblies), are delivered to the plant,—the castings already snagged and cleaned, and the forgings pickled and cleaned — ready for use. In winter the castings are moved into the plant and sprayed with red engine sealer as a prevention against rust formation, but in summer the castings are dipped in sealer in a separate building out in the receiving yard, and then stacked in the plant yard until requisitioned. Forgings, however, are given no preliminary treatment before passing through the necessary machining operations and entering into the various sub-assemblies.

As the different parts are ready, they are moved to the assembly line where the bare engine and other units are assembled. After satisfactorily passing a thorough test they are moved to the painting area where they are hand sanded and given a spray coat of primer followed by a single coat of engine enamel. Such parts of a unit as are not to be painted are masked, while spark plugs are protected by slipping a steel pipe cap over each.

Since Le Roi engines enter into the assembly of a diversified line of products made by other manufacturers,—as in construction machinery, for example, where they are used in loaders, conveyors, finishers, concrete mixers, rollers, etc., as well as literally hundreds of industrial and other types of equipment, such as car pullers, combines, cranes, locomotives, pea vining machinery, ballast cleaners, pipe cleaning machinery, refrigeration machinery, saw rigs, snow plows, well drilling equipment, amusement devices, and many others,—engines that are to become a part of other industrial equipment and are destined to be shipped to the respective manufacturers for assembly, must be painted to meet the requirements and specifications of the respective companies. One may specify green; another may want gray; and still another, orange. Units ordered for use in the army are finished in a lusterless or dull olive green.

If, however, the unit is to enter into the completed assembly of one of the Le Roi engine-generator sets, it is painted green, while the sub-assembled parts of air compressors, including the engine, are painted yellow. Standard paint on small gas engines is gray, and on large gas engines it is green.

A drying period of two or three hours, at room temperature, is allowed between the applications of the primer and the first coat of enamel. Room drying is the general practice. If the unit, when dry, is to be shipped directly to a customer, it is moved into the crating section, adjacent to the painting area. If, on the other hand, it is to become part of one of the finished Le Roi units, it is moved back to the

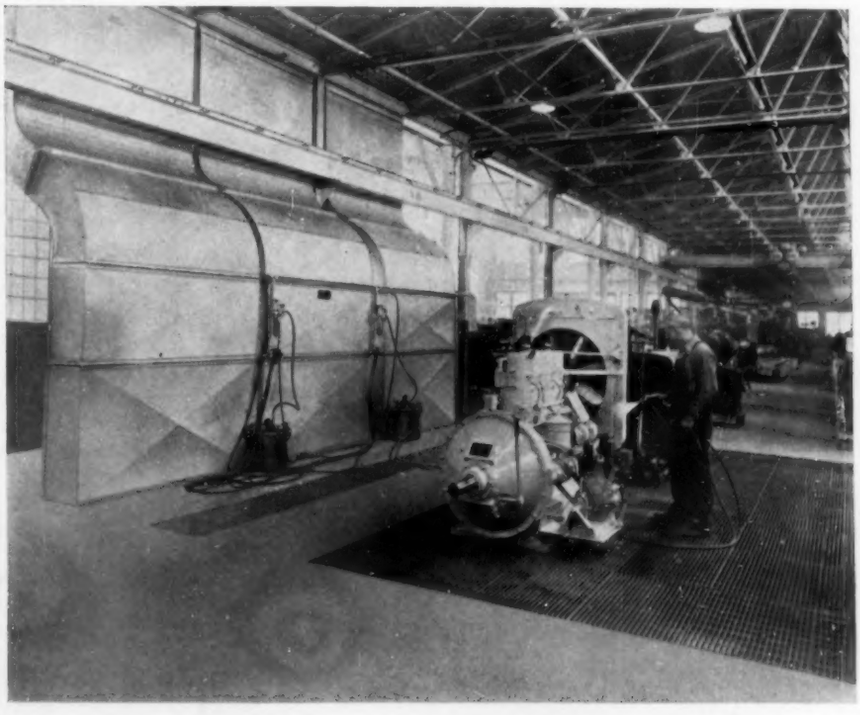

Fig. 1. General view of paint spraying area at the Le Roi plant—down-draft exhaust with no enclosure.
(Courtesy The DeVilbiss Co., Toledo, Ohio)

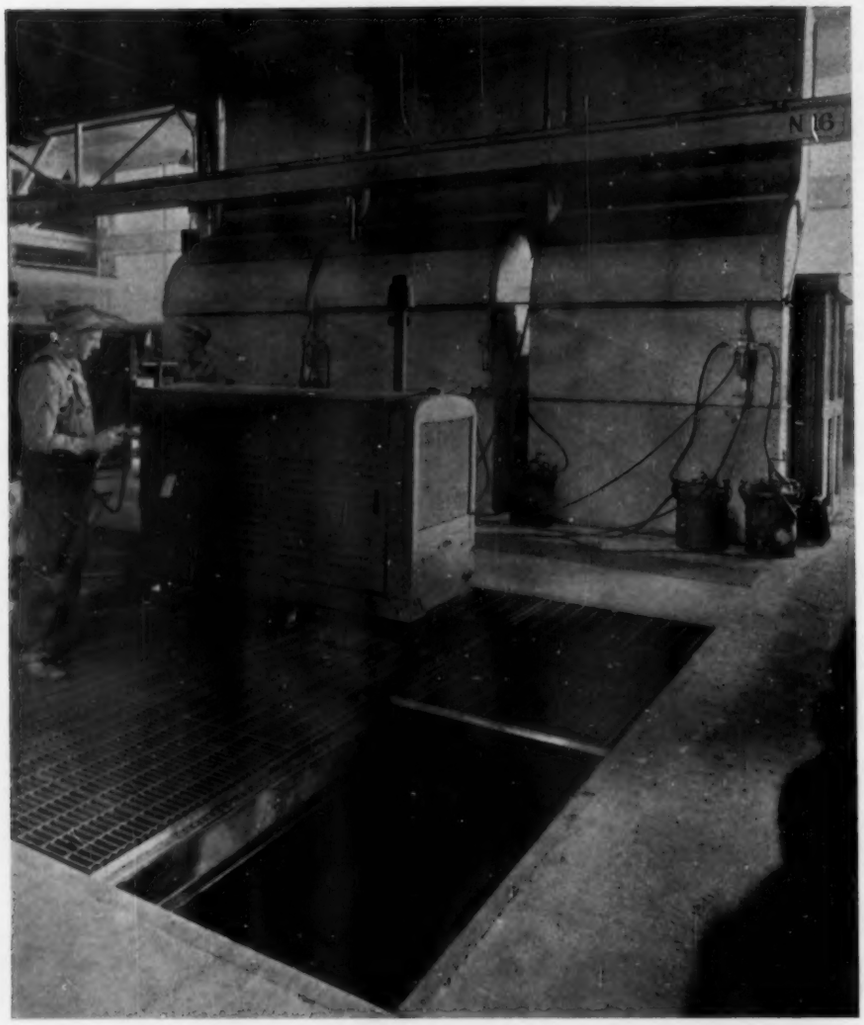

Fig. 2. Painting area with some of the floor grille plates removed, showing water flow in pit. All washing and removal of pigment is carried on below the floor level.
(Courtesy The DeVilbiss Co., Toledo, Ohio)

assembly floor to be assembled with a generator set or in an air compressor frame. After the unit has been completely assembled and has passed a rigid test, it is returned to the painting area for a finish spray coat of synthetic engine enamel,—the generator sets being painted green, and the portable air compressors a highway yellow. Most lettering (raised in the castings) is painted black by hand brushing,—for completed generator units (if not otherwise specified) it is black on a green body, while for the portable air compressors it is black lettering on a yellow body. Wheels of the portable compressor are painted red. For the completed generator units some customers specify color combinations which might be red, white, or aluminum letters on green body. On engines it is also up to the customer, but if not specified, red is usually used for the letters on green body.

The steady though diversified stream of units flowing into the finishing department, each demanding its own color, had so overtaxed the accommodations provided by the two cabinet type booths formerly used, that in order to meet the demands for increased production it was necessary to install the present down-draft, water-wash exhaust system. The wet section is recessed in a reinforced concrete water-tight floor pit, covered by a steel bar floor grating 22 ft. x 11 ft. The absence of any enclosure or partition permits the using of the natural factory lighting, and also eliminates any obstructions to the movement of units onto and off this grating, and provides free movement of workers over the entire spray area. Four operators may work on the grating at the same time, each spraying a different color. An operator's face is at all times above the fume-laden air zone, and it is possible for an operator to work in any portion of the area without being in the path of the fumes from another operator's spray gun. As all overspray falls by force of gravity, the down-draft system merely accelerates and controls the natural fall. Five and ten gallon pressure feed paint tanks are used, with a different color in each tank so as to have the right color at hand whenever it is to be used.

The installation is unusual in that all washing and removal of pigment is done below the floor level. As the air is exhausted from the spray area it is drawn down through the steel grating, through the water-wash section, on through the moisture eliminators, and into the exhaust stacks. There are three exhaust fans, each 48 in. in diameter and of 7½-hp. capacity drawing the fumes through elongated rectangular ducts, which pass upward between two confining crane rails to the roof of the building, where the fans are mounted. The water in the concrete pit is drained off every two weeks, the pit thoroughly cleaned, and fresh water allowed to flow into it to a depth of from one-and-a-half to two feet.

Alkali Resistant Coating

U. S. Pat. 2,276,519 J. L. Sherk and C. F. Cummins, assignors to The Dow Chemical Co., Mar. 17, 1942. A coating composition containing as the sole film forming ingredients a cellulose ether solution in organic solvents and from 20% to 60% of its weight of a heat-hardenable, oil reactive phenol-formaldehyde resin, characterized by ability to deposit a film which, when heat hardened at temperatures between 90 and 150°C. is insoluble in organic solvents and has a melting point above 160°C. at least 35 centigrade degrees higher than that of the film before hardening.

Lacquer Composition

U. S. Pat. 2,279,439 W. D. Bowlby, assignor to Trojan Powder Co., Apr. 14, 1942. A lacquer comprising nitrostarch, a polyvinyl acetal acetate resin having a low viscosity of 20-200 centipoises in a solution containing 20 parts of the resin in 80 parts of toluol, and a volatile solvent medium for the nitrostarch and resin, the composition including the resin of low viscosity giving on spraying and subsequent drying a film that is free from hair-like strands and the proportion of the several materials being about as follows:

Nitrostarch	3 - 5 parts
Polyvinyl acetal acetate resin	10 - 25 "

Plasticizer in amount not substantially in excess of 5 parts for 100 parts of the lacquer.

Finishing Defense Products

PART II

By FRANK V. FAULHABER

Brooklyn, N. Y.

THE importance of a proper thinner cannot be overestimated. The correct reducer for a lacquer, carefully added, governs much the operation of a day's work and its quality. When uncertain of a lacquer reducer, it is advisable to experiment with small quantities, measured with graduation glass, and a record kept of the results, such checking also proving useful for future purposes.

When in doubt of the specific gravity of a finishing material, and to assure a regular uniform quality, the density can be determined by aid of a hydrometer. The use of a thermometer will also be helpful for testing the temperature, whenever there is any question of the working characteristics of a material.

Reference Charts

Some finishing plants hang up charts in a conspicuous place where these can easily be referred to relative to correct solvents for various finishing materials. This further eliminates hazardous guess-work and makes for a more efficiently finished product. All such preparatory measures play a vital part in the correct finishing of shells and other munition products where exactitude is an absolute requisite.

On the outside of projectiles a quick-drying pyroxylin lacquer is sprayed. Experience attests that a lacquer that dries to the touch in 15 seconds is preferred, being very tough and having excellent adhesive qualities. This rapid drying time expedites production, and a more compact conveying equipment can be employed.

Lacquer ordinarily is made up of five ingredients. These are nitrated cotton, solvent, diluent, gum and plasticiser. The solvent dissolves the cotton and may dissolve the gum. The diluent dissolves the gum. The plasticiser keeps the lacquer flexible by remaining in the film. Naturally there are various solvents, diluents and plasticisers. Each has definite chemical characteristics and a certain definite ability to perform its function correctly. Thinners are compounded and balanced with the formula of the lacquer by the manufacturer, ordinarily, to obtain the most efficient results in the finishing room. Whenever possible, it is best to use the thinner recommended by the manufacturer.

Pyroxylin Lacquer

Now, as respects pyroxylin lacquer, used on the shells, one of its principal characteristics is its tendency to conform uniformly in every way to the surface to which it is applied. It does not conduce to fill the pores of the metal and level out. Instead, it penetrates deeply each pore and seals it on the outside completely. Hence, it is pertinent to bear in mind these adhesive properties of pyroxylin lacquer, where the aim sought is a smooth finish. Additionally, the pyroxylin lacquer, with all its good qualities, can only assure as smooth a finish as the surface to which it is applied, thus again stressing the importance of a very thorough surfacial cleaning.

This pyroxylin lacquer requires agitation as it is highly pigmented and drops out of suspension rapidly. If agitation is not done, too much solid material settles to the bottom and, as

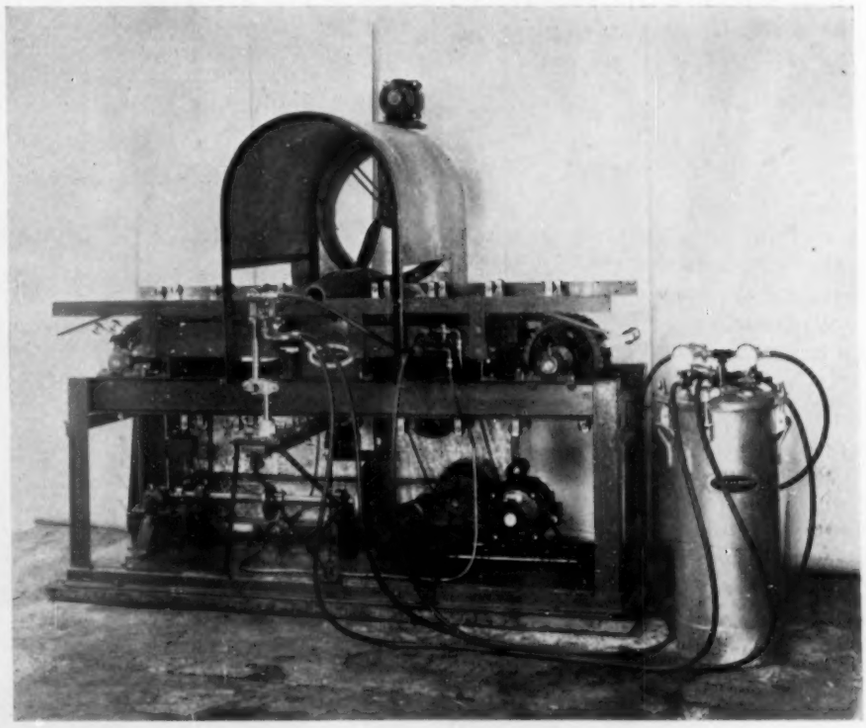

Illustration of bench type sprayer for automatically coating the interior of shells. Rate on 155 mm. shells is 500 per hour.

(Courtesy Eclipse Air Brush Co., Newark, N. J.)

operations progress, notable changes occur in the viscosity and general proportions of the ingredients in the finishing liquid. For superior results, all pigment that has settled to the bottom of the container must be loosened up and thoroughly mixed with the liquid.

Mechanical stirrers and agitators of various sorts have been constructed for mixing and stirring finishing materials. These may be operated continuously or intermittently, conformable with the individual finishing program. Ordinarily, what stirs a material in its container is one or more horizontal paddles attached to a vertical or nearly vertical shaft, the paddles turning propeller-like near the bottom of the container, while the upper portion of the shaft is supported by one or more bearings in or near or attached to the lid of the container. In a tall tank an additional bearing—an outboard bearing—is usually provided near the bottom of the tank to steady the shaft.

An agitator of this type, operating inside the container, may be manipulated by a hand crank or by an air motor, employing power from the compressed air line, or by aid of a small electric motor. When several containers are permanently aligned in a row, a line of shafting may be arranged to transmit power to the agitator shafts. With such a set-up it is possible to connect and disconnect, independently, the agitator shaft of each container.

Agitator Set-up

Such facilities, incorporating an air motor, electric motor or a belt-driven agitator, obviates the necessity of the spray operator interrupting his work to agitate the materials, thus speeding up this phase of operations.

Most material containers for this work are equipped with air-motored agitators so that a constant agitation of any desired speed can be obtained by air intake control. The agitator is turned on for about ten minutes before the spraying operation is begun. It is good practice to have two material containers, so that there will be no break in production, and the material can be mixing in the spare tank before it is put on the line.

An air motor drive can be operated by means of the compressed air available at the tank lid. It can be attached or detached instantly by simply lifting on or off the agitator shaft and connecting or disconnecting the air hose. The speed of the motor can be regulated by a valve, and is adjustable. The air consumption of such a motor is from 5 to 6-cu. ft. a minute at 20-r.p.m.

With an electric motor drive there is constant and vigorous agitation of the finishing material, especially those containing heavy pigments. These can be had in two types of electric motor, totally enclosed, and explosion resisting, the latter particularly for use with paint, lacquer and kindred finishes.

Operating as a single unit, the electric motor drive can instantly be attached or detached from the lid tank. This equipment is manufactured in a range of sizes, for pressure-feed tanks from 5 to 300-gallon capacity. For purposes of operating several agitators on a series of pressure-feed tanks, from one source of power, a multiple gear drive or a belt drive can be set up.

There are available gravity-feed material containers sized from two to ten gallons, equipped with either one or two different types of power agitators, as well as hand-operated agitators. In one, a pair of slender stirring paddles is attached to the lower end of the

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We Have Enlisted for VICTORY!

★

We, in common with thousands of manufacturers throughout the land, have enlisted for the duration and ...— victory!

This means we are devoting a great deal of our time and our resources to the production of finishes for shells, machines, tanks and a host of other products so vitally needed by our armed forces for the successful completion of the gigantic struggle now in progress.

It does not mean that, because of our defense program, we are making no effort to serve that portion of our trade engaged in so-called non-essential manufacturing. Naturally, however, defense production comes first. We must wage an all-out fight to keep 'em rolling!

This makes for substitutions and shortages in many items normally plentiful. If, as a result, you experience delays or other inconveniences, please be patient and try to remember we are doing our best . . . Our best for the cause and our best for you.

A spirit of mutual understanding and cooperation between buyer and seller in all lines today will go a long way toward lightening the burden for everyone.

THE EGYPTIAN LACQUER MANUFACTURING CO.

Rockefeller Center • New York, N. Y.

★ ★ ★ ★ EGYPTIAN FINISHES ★ ★ ★ ★

shaft, which is rotated by a small air motor positioned on or built into the top of the lid. The rotary action serves to lift the heavy portion of the material to the top.

Air Jet Agitator

In one outfit, known as an air jet agitator, there is an inverted T-assembly of slender pipe that suspends from the container cover. Small apertures drilled in the horizontal section of the pipe release jets of air into the bottom of the tank, and as this escaping air bubbles up through the liquid contents, a mild agitation of finishing material ensues, efficaciously as intended.

Intelligent, careful use of the correct type of stirrer will result in less wastage of material and tend to preserve the original uniformity and working consistency of the finishing liquid. Pigmented materials will not stay mixed indefinitely, hence the need for frequent agitation. If the stirring is not thorough, the material will be thin on top and thick on the bottom of the container. Also, the finish will be too glossy or too flat, lack body and lustre, and will be off color. The thick material on the bottom will conduce to chalkiness in the film, which is not durable, and unadhering to the surface, particularly detrimental in the finishing of shells. The thin material at the top will have poor hiding or covering power, and will contain an excess of oil and resin, which may result in lifting when the dried film is coated with lacquer.

Whenever the coating appears powdery on the projectiles, it is an indication that the lacquer is not being sufficiently agitated. Stirring should continue until it flows properly. The lacquer should be carefully filtered, in order to obtain a clear, clean-flowing liquid, all foreign substances, such as specks, dirt, dust, and paint skins to be removed by straining. If this is not done, aside from the spoilage of work and impeding of smooth operations, there may be frequent necessity to cull out imperfections from the processed work.

Impurity Hazards

When the finishing material is not strained, there will be cloggage of the hose or spray guns, causing the surface coat to reveal nibs and dirt specks. This will result in loss of time due to cessation of operations to flush out the hose or to take the equipment apart in order to remove the offending small particles of dirt or lumps. To re-work over such shells as are spoiled, thusly entails extra time in rubbing, and the work as a whole is marred and it is a question whether it will pass inspection.

Generally, lacquers, nowadays, are finer than ever, and even though for ordinary purposes their use without straining might serve, for shell finishing it is particularly desirable, to ensure a more exacting finish. Lacquers do not perform uniformly and there may be operating interferences, such as would be occasioned by exposure of the lacquer. Material containers, of course, should always be kept closed. There is an extra safeguard in the prevention of impurities in the material from reaching the spray gun, pressure feed tanks being equipped with a screen strainer at the intake of the fluid tube.

All barrels, steel drums or cans containing finishing materials are supposed to be clean when filled and every effort is usually made by the manufacturer to see that these are cleaned before being refilled again. Nevertheless, in the interest of certainty, superior workmanship and economical, uninterrupted production, all material to be used should be strained. It is a surety, the more straining that will be undertaken, the fewer disconcerting finishing troubles will attend.

The straining can be done by fine wire-screen process or by means of cheese cloth. One type of strainer for straining small quantities of material at a time is available in packages, 100 to the box, folded up. When opened and hung from hooks, such a strainer resembles somewhat a pocket with a pointed bottom.

Straining Procedures

These strainers are economically-priced, can be used once or twice and then discarded. Available in two different meshes, one appropriate for clear lacquers and varnishes, the other for pigment finishes, such as paints and enamels, these will prove serviceable for this particular work.

One method is by way of tacking a cloth onto a wooden frame; another, an ingenious arrangement permits facile placement of a cloth over a circular strainer, adjusting and clamping securely the cloth over the frame, and as quickly discarding as befits need. These strainers are procurable in a number of sizes, extra large ones being fitted for vibratory purposes.

In some cases, two or three sheets of a filter paper are employed, the material to be strained being placed in the center. Silk cloth or organdy also will serve if it is deemed that the usual cheesecloth method is inadequate. Nevertheless, cheesecloth has proved an efficacious straining agent. After use, it can be placed in an alkali bath or similar renewing process, dried, later to be re-used. Cheesecloth, moreover, is inexpensive; it intercepts all particles of any appreciable size resident in finishing materials.

ENTHONE **RETARDER**

Eliminates

LACQUER BLUSHING

During warm, humid days, lacquers frequently "blush" resulting in weak, unsatisfactory films.

Enthone Retarder has been used for 10 years to eliminate blushing and enable lacquering in the humid days of summer.

Enthone Retarder is easy to use, has wide compatibility and gives the lacquer better flow-out—thus reducing orange peel.

Order Enthone Retarder NOW to be Ready When Blushing Troubles Come.

THE ENTHONE CO. NEW HAVEN, CONN.

Through rose colored glasses

Your customer likes your product. That's why she bought it. But remember that she will not look at it always through rose colored glasses.

When enthusiasm wanes . . . when the inevitable day of critical examination arrives . . . finish will be a highly important factor of satisfaction. And on that day will be determined the true acceptance of your product.

The right finish . . . a finish engineered to your specific needs . . . can insure lasting customer satisfaction. It can cut your finishing time, reduce your finishing costs and increase the salability of your product.

The right finish, in short, will make more money for you.

We can help you find the right finish for YOUR product . . . the finish that stands up after the rose colored glasses come off . . . the finish that pleases finishing foremen (who, quite correctly, never wear rose colored glasses anyway).

Your inquiry incurs no obligation. Address Department "E."

THE STANLEY CHEMICAL CO.

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Lacquers · Enamels · Synthetics · Japans

A SUBSIDIARY OF THE STANLEY WORKS. NEW BRITAIN. CONN

NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

Glass Coating to Prevent Shattering

Wilbur & Williams Co., Park Square Building, Boston, Mass., have announced a new coating material to be applied to glass to prevent shattering. This transparent material comes in liquid form and ready for use, and can be applied by spraying or brushing.

The coatings produced are stated to weather with very little discoloration and absorb little sunlight. The coatings dry quickly, forming strong films, and have tensile strengths from 3000 to 5000 lb./in.^{2} Elongation is claimed to be over 20% thus permitting considerable movement of the glass without rupture of the film.

The melting point of the coating is over 200°C. and thus excellent protection is claimed for temperatures up to 212°F. The material is recommended for use on windows of schools, hospitals, offices, factories or any place where the shattering of glass would be a hazard.

Metal Primer to Replace Aluminum Paint

The Midland Paint & Varnish Co., Cleveland, Ohio, have announced the development of a product called "Hyspar Metal Lead Primer," which is suggested as an alternative material in place of aluminum paint for priming.

This material is claimed to offer a protective value to steel equal to that of a good grade of aluminum paint. The material may be brushed, sprayed or dipped, and dries hard in 4 to 5 hours. It is neutral gray in color and thus the color does not tend to bleed through the finishing coat. Good resistance is claimed against rapid changes in weather and also to salt-impregnated air at the seacoast.

The paint can be obtained in two forms. It can be supplied already mixed for application, or in separator cans with the metal paste separate from the liquid, to be mixed in the same fashion as previously required for aluminum paints.

Insulating Varnish

The Sterling Varnish Company, 151 Ohio River Blvd., Haysville, Pa., has recently developed a new insulating varnish, designated as S-110, for application to electrical apparatus that must operate at abnormally high temperatures. Tests have indicated that S-110 will stand operating temperatures at 250°C. or higher.

When baked at 175-200°C. it dries all the way through the deepest winding and does not resoften when exposed to high operating temperatures. The dried film is mechanically strong, exceptionally adhesive and flexible, and retains these characteristics under adverse heat conditions, according to the manufacturer.

Parts Coated with Insulating Varnish

The experience of one motor manufacturer confirms the unusual operating efficiency of Sterling S-110 insulating varnish at abnormally high temperatures.

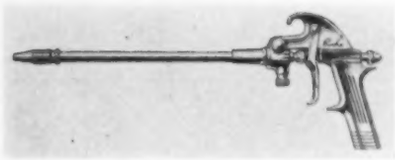
A machine had been wound with glass covered wire and insulated with glass and mica, after which it was treated with two coats of S-110. The machine was then run to destruction. Upon investigation, the insulation varnish was found to be in excellent condition and the stator showed no signs whatever of breakdown even though the rotor bars had loosened due to the brazing having melted away. The brazing material in question melts at 700-800°C. The insulation test on the stator was perfect and when a new rotor was put into the machine, and fresh grease in the bearings, the motor started up without any trouble whatsoever.

The manufacturer will be glad to furnish additional information upon request.

Cleaning Gun

Binks Manufacturing Co., 3114 Carroll Ave., Chicago, Ill., have announced the development of a new cleaning gun called "Binks No. R3-EC", which is recommended for spraying various solvent type cleaning materials.

The gun can be used for kerosene and various safety solvents and naphthas. It is



Gun for Cleaning with Solvents

equipped with a pistol grip, adjustable material control, adjustable nozzle and ¼" standard pipe thread air connection. It uses approximately 4 C.F.M. at 40 to 50 lb. pressure. The gun can be used with a quart syphon cup or with suction hose, running into an open container. Net weight is 1½ lb.

Spray Booth Cleaning Compounds

Triad WS and WSF spray booth cleaners for use respectively in booths where oil base paints and enamels are sprayed, are described in a new leaflet issued by *Detroit Rex Products Company*, 13005 Hillview Ave., Detroit, Michigan. It tells how vital parts of spray booths may be kept from becoming fouled by paint pigments.

New Book

Protective and Decorative Coatings. By Dr. J. J. Mattiello. Volume I. Raw Materials for Varnishes and Vehicles. Published by John Wiley & Sons, Inc., New York. Size 6" x 9"; 803 pages. Price $6.00.

This much-needed book represents the compilations of the efforts of a staff of specialists under the editorship of Dr. Mattiello, Technical Director of the Hilo Varnish Corporation.

The book was written primarily to supply basic data and information pertaining to protective and decorative coatings, and it is the reviewer's opinion that this purpose has been attained.

Three volumes are scheduled, and Volume II of the series will appear shortly.

The first portion of Volume I is devoted to a general picture of the paint and varnish industry, discussing the rise of the industry, developments to date and the future of the industry. The second section is devoted to drying oils, such as cashew nutshell oil, oiticica oil, castor oil and various synthetic drying oils. The third section is devoted to resins, including rosin and other natural resins, such as shellac, ester and copal resins as well as the new synthetic resins, such as the phenolic and alkyd resins.

Through rose colored glasses

Your customer likes your product. That's why she bought it. But remember that she will not look at it always through rose colored glasses.

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NEW EQUIPMENT AND SUPPLIES

LATEST COMMERCIAL DEVELOPMENTS IN ORGANIC FINISHING

Glass Coating to Prevent Shattering

Wilbur & Williams Co., Park Square Building, Boston, Mass., have announced a new coating material to be applied to glass to prevent shattering. This transparent material comes in liquid form and ready for use, and can be applied by spraying or brushing.

The coatings produced are stated to weather with very little discoloration and absorb little sunlight. The coatings dry quickly, forming strong films, and have tensile strengths from 3000 to 5000 lb./in.^{2} Elongation is claimed to be over 20% thus permitting considerable movement of the glass without rupture of the film.

The melting point of the coating is over 200°C. and thus excellent protection is claimed for temperatures up to 212°F. The material is recommended for use on windows of schools, hospitals, offices, factories or any place where the shattering of glass would be a hazard.

Metal Primer to Replace Aluminum Paint

The Midland Paint & Varnish Co., Cleveland, Ohio, have announced the development of a product called "Hyspar Metal Lead Primer," which is suggested as an alternative material in place of aluminum paint for priming.

This material is claimed to offer a protective value to steel equal to that of a good grade of aluminum paint. The material may be brushed, sprayed or dipped, and dries hard in 4 to 5 hours. It is neutral gray in color and thus the color does not tend to bleed through the finishing coat. Good resistance is claimed against rapid changes in weather and also to salt-impregnated air at the seacoast.

The paint can be obtained in two forms. It can be supplied already mixed for application, or in separator cans with the metal paste separate from the liquid, to be mixed in the same fashion as previously required for aluminum paints.

Insulating Varnish

The Sterling Varnish Company, 151 Ohio River Blvd., Haysville, Pa., has recently developed a new insulating varnish, designated as S-110, for application to electrical apparatus that must operate at abnormally high temperatures. Tests have indicated that S-110 will stand operating temperatures at 250°C. or higher.

When baked at 175-200°C. it dries all the way through the deepest winding and does not resoften when exposed to high operating temperatures. The dried film is mechanically strong, exceptionally adhesive and flexible, and retains these characteristics under adverse heat conditions, according to the manufacturer.

Parts Coated with Insulating Varnish

The experience of one motor manufacturer confirms the unusual operating efficiency of Sterling S-110 insulating varnish at abnormally high temperatures.

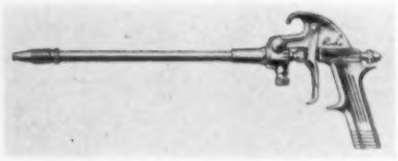
A machine had been wound with glass covered wire and insulated with glass and mica, after which it was treated with two coats of S-110. The machine was then run to destruction. Upon investigation, the insulation varnish was found to be in excellent condition and the stator showed no signs whatever of breakdown even though the rotor bars had loosened due to the brazing having melted away. The brazing material in question melts at 700-800°C. The insulation test on the stator was perfect and when a new rotor was put into the machine, and fresh grease in the bearings, the motor started up without any trouble whatsoever.

The manufacturer will be glad to furnish additional information upon request.

Cleaning Gun

Binks Manufacturing Co., 3114 Carroll Ave., Chicago, Ill., have announced the development of a new cleaning gun called "Binks No. R3-EC", which is recommended for spraying various solvent type cleaning materials.

The gun can be used for kerosene and various safety solvents and naphthas. It is



Gun for Cleaning with Solvents

equipped with a pistol grip, adjustable material control, adjustable nozzle and ¼" standard pipe thread air connection. It uses approximately 4 C.F.M. at 40 to 50 lb. pressure. The gun can be used with a quart syphon cup or with suction hose, running into an open container. Net weight is 1½ lb.

Spray Booth Cleaning Compounds

Triad WS and WSF spray booth cleaners for use respectively in booths where oil base paints and enamels are sprayed, are described in a new leaflet issued by *Detroit Rex Products Company*, 13005 Hillview Ave., Detroit, Michigan. It tells how vital parts of spray booths may be kept from becoming fouled by paint pigments.

New Book

Protective and Decorative Coatings. By Dr. J. J. Mattiello. Volume I. Raw Materials for Varnishes and Vehicles. Published by John Wiley & Sons, Inc., New York. Size 6" x 9"; 803 pages. Price $6.00.

This much-needed book represents the compilations of the efforts of a staff of specialists under the editorship of Dr. Mattiello, Technical Director of the Hilo Varnish Corporation.

The book was written primarily to supply basic data and information pertaining to protective and decorative coatings, and it is the reviewer's opinion that this purpose has been attained.

Three volumes are scheduled, and Volume II of the series will appear shortly.

The first portion of Volume I is devoted to a general picture of the paint and varnish industry, discussing the rise of the industry, developments to date and the future of the industry. The second section is devoted to drying oils, such as cashew nutshell oil, oiticica oil, castor oil and various synthetic drying oils. The third section is devoted to resins, including rosin and other natural resins, such as shellac, ester and copal resins as well as the new synthetic resins, such as the phenolic and alkyd resins.

Other resins discussed are coumarone-indene, urea-formaldehyde, maleic, vinyl and acrylic, and various synthetic hydrocarbon resins.

Sections are also devoted to driers, thinners and solvents. One section discusses natural minerals and particularly asphalts and asphalt paints, and lastly, ethyl cellulose as a typical ether is treated.

The book is well printed and edited, and is a welcome addition to the literature on organic finishing.

Business Items

J. B. Wiesel Advisor to WPB

J. B. Wiesel, Director of Sales of the Cellulose Products Department of *Hercules Powder Company*, has been appointed advisor to *J. B. Davis*, Chief of the Protective and Technical Coating Section of the War Production Board, the company announced today. He will have charge of the allocation of nitrocellulose and ethyl cellulose.

Mr. Wiesel will devote half his time to the board work in Washington, and half to his work with Hercules. The company is contributing his services to the WPB.

"Because of the rapid increase during recent weeks in the requirements for nitrocellulose for the war program, it has been necessary to reduce drastically the quotas alloted to commercial consumers," the company said. "To minimize confusion and dislocation in the consuming industries, the War Production Board has asked Mr. Wiesel to act as an advisor to serve in the interests of all nitrocellulose consumers and producers.

"Objectives of the allocation of cellulose materials will be: first, to make certain the war program continues to obtain all the commercial nitrocellulose and ethyl cellulose required; and second, to distribute the remainder of the available materials equitably, so as to produce the minimum dislocation of established business."

Patents on Wrinkle Finish Upheld by Federal Court

On March 26th the United States Court at Buffalo, N. Y., rendered a decision in the case of *New Wrinkle, Inc.* of Dayton, Ohio, owner of patents on Wrinkle Finishes widely used in industry, upholding the validity and infringement of these basic patents. The case was defended by the *Pontiac Varnish Company* of Pontiac, Michigan, a manufacturer of varnishes and enamels.

The Court examined the extensive defenses and found that wrinkle finishes were broadly new as covered by the patents in suit. These patents are licensed to one hundred and sixty leading paint manufacturers of the United States and also to manufacturers in England and other foreign countries.

New Wrinkle, Inc. was represented in this case by Toulmin & Toulmin, of Dayton, Ohio as General Counsel and Frederick S. Duncan of New York City as Associate.

According to the Associated Press report, the Court decision prevents the Pontiac Varnish Company from any further infringement of the patents in suit.

David Donovan has left the Advertising Department of *Interchemical Corporation*, New York, N. Y. to receive a commission as Ensign in the United States Navy. He is now on active duty at the Naval Air Station, Jacksonville, Fla.

Elon R. Brown, formerly with Station KMAC, San Antonio, and the Lambert Pharmacal Company, St. Louis, has joined Interchemical's advertising staff.

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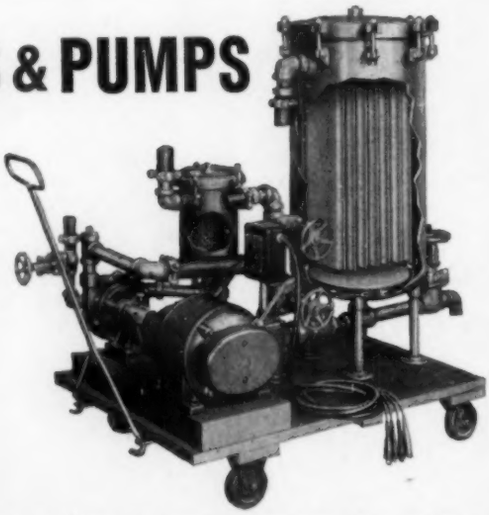

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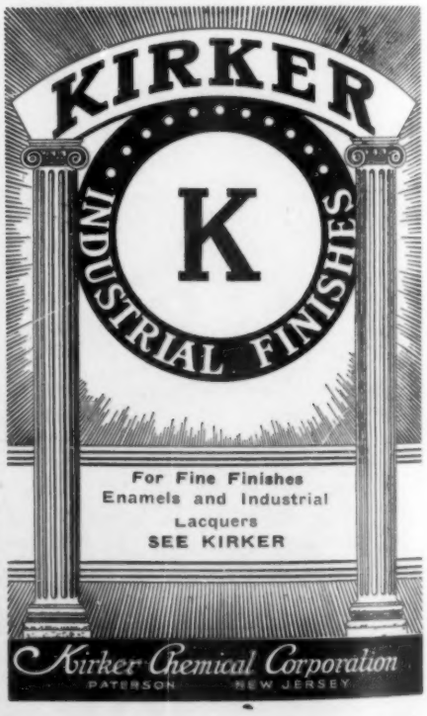

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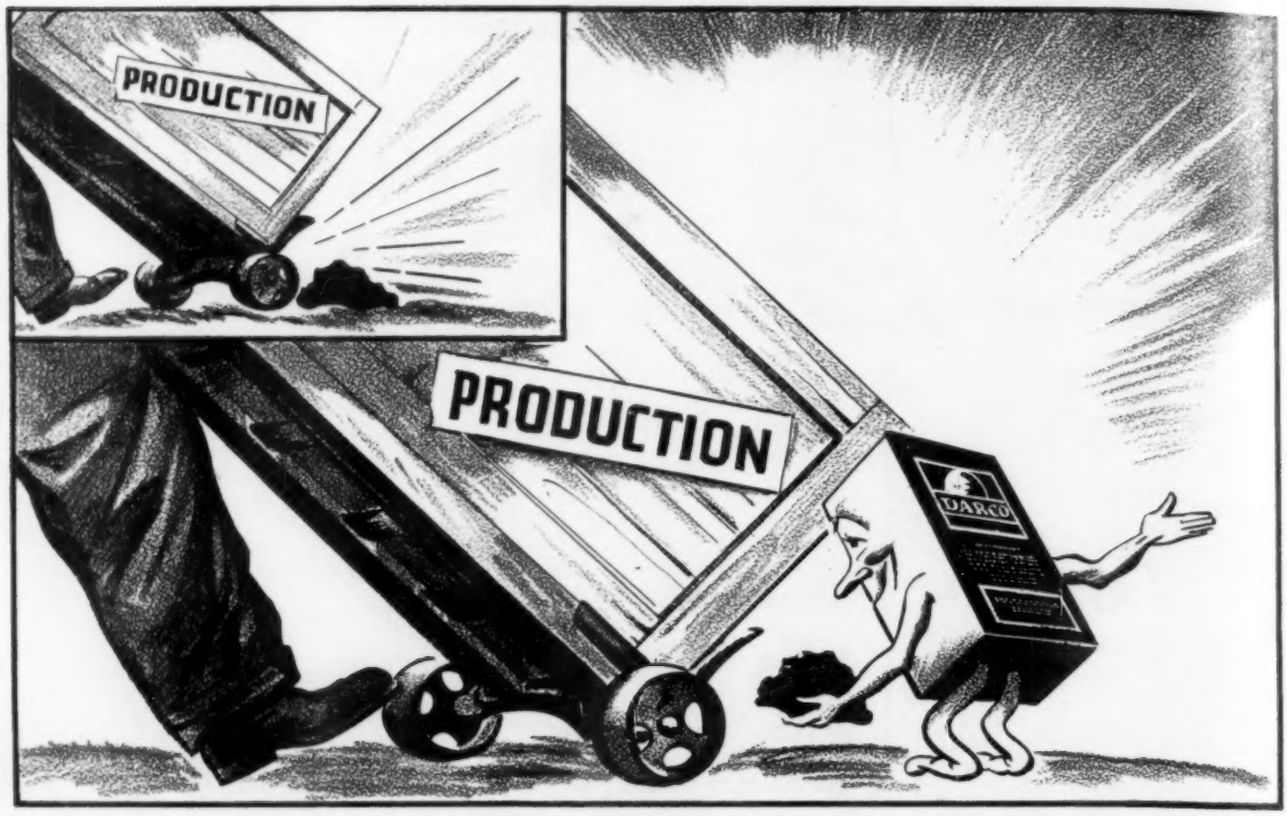
METAL FINISHING (formerly Metal Industry) has been the leading publication since 1903 in the field of metal preparation, electroplating and coating.



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VOL. 40, NO. 6 METAL FINISHING JUNE, 1942
PREPARATION, ELECTROPLATING, COATING

Electroplaters Meet at Grand Rapids

The American Electroplaters' Society will hold their 30th annual convention at Grand Rapids on June 8, 9 and 10. In view of the increased demands made upon the members by the war program, the convention has been streamlined to three days. Twenty-one technical talks have been scheduled and the processes most important to the war program will be discussed. Some of these problems include military applications of electroplating, copper plating as a stop-off for carburizing, surface treatments of magnesium, anodizing of aluminum, and finishes for military aircraft. New developments in plating, such as indium plating and lead plating from the sulfamate baths will be discussed.

As in the past, the people attending the convention will be amply repaid from the wealth of technical knowledge presented at the educational sessions as well as from associations with other technical men in the industry.

New Restrictions Pertaining to Plating

Several important orders, as far as the plating industry is concerned, were issued during May. An important revision of the M-9-c Order issued May 7, 1942, prohibits the use of copper in a long list of articles and included in this list is copper plating. Copper plating of the articles on the banned list went into effect May 31st. Those doing copper plating or using copper alloys should acquaint themselves with the provisions of this new order.

Another order vital to the plating industry is Order M-11 amended May 1, 1942. This order places the distribution of zinc under allocation by the War Production Board. This order requires the filing of a certificate to deliver or accept delivery of zinc. No restrictions are placed on the use of zinc in plating, but as noted above, the obtaining of the zinc for plating will be at the discretion of the War Production Board.

The metal arsenic used in plating a black smut and also occasionally a brightener in plating was placed under allocation by issuance of General Preference Order No. M-152 effective May 22nd. The order provides that no producer or distributor of arsenic may make delivery to any person unless he has specific authorization from the Director of Industry Operations. This order was made in anticipation of a future shortage and not because the material is short at the present time. Arsenic refers to the crude metal or refined metal as well as arsenious acid or arsenic trioxide.

Another important order is the limitation order L-110 which places limitation on the sale of equipment used for plating or anodizing. This order restricts the manufacture, delivery and sale of electroplating and anodizing equipment to orders rated A-1-j or higher. The purpose of the action is to make certain that existing electroplating and anodizing plants and equipment are not unnecessarily duplicated and to see to it that the type of equipment constructed is not wasteful of critical materials.

In issuing ratings for the production, sale or delivery of electroplating and anodizing equipment, the WPB will consider (a) the number and capacity of such facilities available in a particular locality; (b) the anticipated need for such equipment in that locality; (c) the number of uncompleted orders placed prior to the issuance of the order and the amount of work done on such orders.

This will help to divert war work into the plants of job platers who have the facilities, instead of (as in the past) permitting prime contractors to install unnecessary new plants.

NEWS FROM WASHINGTON—

By George W. Grupp
Metal Finishing's Washington Correspondent

UNPREDICTABLE WASHINGTON

Washington is unpredictable during these abnormal times. Each week established agencies are re-organized, old agencies are decentralized, new agencies are created, yesterday's regulations are revoked, and new orders are issued. Changes come so thick and fast that not only businessmen who come to Washington, but also some Government executives and workers, call for an aspirin or two.

TWO IMPORTANT CHANGES

One of the most important changes to take place shortly is the entire procedure of the priorities system because large quantities of vital materials are alleged to have leaked into non-essential industries, and because in other places unbalanced and excessive inventories were said to have been found. Another important change will be the stoppage of certain war plant expansion. That expansion, however, which is in the process of construction will not be stopped.

GENERAL EXPORT ORDER

Director J. S. Knowlson of WPB's Industry Operations Division on May 12, 1942 issued General Export Order M-148 restricting the exporting of such critical materials as cobalt, copper, brass, bronze, copper sulphate, lead, tinplate, tin, molybdenum wire, tungsten metal, wire, shapes and alloys, acetic acid, ammonium sulfate, anhydrous ammonia, carbon tetrachloride, caustic soda, copper sulfate, methyl alcohol, potassium permanganate, sulfuric acid and graphite.

CONVERT OR BE SEIZED

Nothing is too certain and reasonably long of duration except the life of a huge war contract in the process of execution. Countless businessmen, especially the small ones, will have to fight and convert their plants into war production or die and have their machinery seized because the War Production Board program provides for the requisition of all lathes, grinding devices and other machine tools of all firms and individuals without war orders. The first to be hit will be the sheet metal industry and the metal stamping plants.

NEW METAL PRICE SCHEDULE AHEAD

The Office of Price Administration will soon announce a new price schedule on aluminum scrap, brass mill scrap, copper scrap, copper alloy scrap, lead scrap, nickel scrap, nickel alloy scrap and zinc. This new price schedule will be based on two meetings, one in Chicago and one in New York, of several hundred non-ferrous scrap dealers and Government officials.

SILVERPLATE COMMITTEE APPOINTED

T. Spencer Shore, Chief of the WPB Bureau of Industry Advisory Committees, announced the appointment of a Silverplate Flatware Advisory Committee consisting of *Miles E. Robertson* of Oneida Limited of Oneida, New York; *J. McKensie Morrison* of Ontario Manufacturing Company of Munsie, Indiana; *A. K. Hobson* of Hobson & Botts Company of Danbury, Connecticut; *E. C. Stevens* of International Silver Company of Meriden, Connecticut; and *J. L. Maury* of the WPB as the Government presiding officer.

CUTLERY COMMITTEE APPOINTED

At the same time Mr. Shore announced the appointment of a Cutlery Advisory Committee consisting of *H. Alpern* of Pal Blade Company of Holyoke, Massachusetts; *S. L. Berger*, president of Rex Cutlery Company of Irvington, New Jersey; *G. E. Chatillon*, president of Foster Brothers Cutlery Division of John Chatillon & Sons of New York City; *C. H. Corbin*, treasurer of Ontario Knife Company of Franklinville, New York; *C. E. Dorrel*, vice president of Russel Harrington Cutlery Company of Southbridge, Massachusetts; *Alfred Kaster*, president of Camillus Cutlery Company of New York City; *C. L. F. Wieber*, president of Henkel Claus Company of Fremont, Ohio; *Norman Wiss*, president of J. Wiss & Sons Company of Newark, New Jersey; *Ralph E. Herman* of Star-Brite Production Corporation of New Haven, Connecticut; and *Jesse L. Maury* of the WPB as the Government presiding chairman.

CREDIT REGULATION

Federal Reserve Regulation W, effective May 6, 1942, provides that the "extension of installment credit, extending of credit in charge accounts, making single-payment loans in amounts of $1,500 or less, or discounting or purchasing obligations arising out of such extensions of credit" shall apply, among other items, to automobile batteries and accessories, lighting fixtures, cutlery, and silverware (including flatware and hollow ware, whether solid or plated). Those who extend installment credit and charge sales of these and other items covered by the regulation must be licensed; the down payment cannot be less than one third of the cash price; the installment payments cannot be less than $5.00 per month or $1.25 a week; the installment amounts must be substantially equal; the time intervals must be equal and not more than one month apart; the maturity of all installment credit is 12 months; a detailed written record of all credit agreements and purchase transactions must be kept by the obligee and he must issue a duplicate copy to the obligor for all purchases in excess of $6.00; all charge accounts must be paid by the 10th of the second calendar month following the month the goods were bought; and a charge account may be converted into an installment credit prior to default.

ALUMINUM PLANT EXPANSION

When Secretary of Commerce Jesse Jones testified before a Senate Banking Sub-committee for the purpose of asking Congress for an additional five billion dollars for the Reconstruction Finance Corporation he said that part of this money would be needed to finance an aluminum plant expansion program which would produce 2,100,000,000 pounds of this metal by 1943.

ALUMINUM RESIDUES ORDER

Amendment No. 1 of Supplementary Order No. M-1-d-1, dated May 2, 1942, provides that the makers of 5,000 pounds of aluminum residues such as drosses, skimmings, fines, grindings, sawings, and puffings must segregate their scrap; and upon the sale of such scrap the seller must furnish the buyer with a signed document stating the alloy number or specification, the form, the weight on a dry and clean basis, and the name and address of the plant where it was generated.

COPPER PURCHASES OF GOVERNMENT

About 100,000 copper fabricators and owners of copper inventories have been notified by the War Production Board that the Government will buy their frozen stocks. Representatives of the industry and the Government have worked out a price schedule which ranges from 15 cents to 30 cents a pound depending upon the form. Fabricated copper products will be bought at prices up to two and one half times their scrap value. This nation-wide copper salvage campaign is expected to yield about 255,000 tons of copper and about 45,000 tons of zinc. The physical transfering and payment of the purchases will be made by the Copper Recovery Corporation, a non-profit organization created to act as agent for the Metals Reserve Company, a subsidiary of the Reconstruction Finance Corporation.

LOAN LIAISON OFFICERS

The Army has detailed liaison officers to all Federal Reserve Banks and branches throughout the United States to help war sub-contractors secure loans. These officers are authorized to make Army commitments up to $100,000. Larger sums will have to be reviewed by the War Department Advance Payment Services of Supply. A schedule of fees for Army guarantees of loans have been set by the Board of Governors of the Federal Reserve System. Those sub-contractors who desire a loan may apply either at their local banks or a Federal Reserve Bank.

BRASS MILL SCRAP

Amendment No. 1 to the recently Revised Price Schedule No. 12 which deals with brass mill scrap provides that every dealer in brass mill scrap must be licensed. This amendment, which became effective May 18, 1942, includes an enforcement penalty of "treble damages provided for by the Emergency Price Control Act of 1942."

BATTERY AND BENZOL ORDERS

The supplementary limited Order L-4-b on batteries, and issued by the War Production Board on April 27, 1942, aims to save 46,000,000 pounds of lead and 1,600,000 pounds of antimony. The present curb placed on benzol it is believed will release large quantities of coal tar products for the production of synthetic rubber.

ELECTROPLATING AND ANODIZING EQUIPMENT

General Limitation Order L-110 of the War Production Board, dated May 11, 1942, has restricted the delivery, manufacture and sale of electroplating and anodizing equipment to orders with a rating of A-1-j or higher. This restriction was ordered to prevent unnecessary duplications of electroplating and anodizing plants, and to curb the wasteful use of copper, rubber and steel which goes into such equipment.

ELECTROPLATING BUSINESS TO INCREASE

In commenting upon this order, William McCord, Chief of the Electroplating Unit of the WPB Unit of Consumers Durable Goods Branch said: "This order is not intended to stop the manufacture of electroplating and anodizing equipment. Such equipment will be needed, probably in increasing amounts, as part of the war program. For instance, steel is being substituted for brass in cartridges. Steel will have to be electroplated and that one item alone will require a considerable quantity of electroplating equipment. What this order is intended to do is to prevent the location of electroplating plants in localities where existing facilities are adequate and to prevent the unnecessary use of critical materials in new equipment."

ENAMELS, SHELLAC, LACQUER PRICES

Enamels, shellac, lacquer enamel and other paint prices have been frozen by the Office of Price Administration to the April 12, 1942 level. It is reported that the users of shellac are seeking substitutes because of the increasing difficulties in securing this finishing material.

CIVILIAN COPPER PRODUCTS BANNED

Copper and its alloys, including brass and bronze, have been banned in the production of over 100 civilian products beginning May 31, 1942. Additional items will be added to this list some time during the month of June.

COPPER PRODUCTS SHIPMENT RESTRICTIONS

A tremendous war production demand for brass mill, foundry and wire mill copper products has resulted in a WPB order, on May 7, 1942, which restricts the shipment of these commodities to those having an A-1-k or higher rating. Specific authorization must be had for the shipment of such products with a lower rating.

HIGHER RATING FOR MAINTENANCE SUPPLIES

J. S. Knowlson, Director of Industry Operations of the War Production Board, has lifted from A-3 to A-1-c the priority rating of suppliers of maintenance materials and repair parts needed in the operation of mills which roll, draw or extrude copper or copper base alloys.

CHROMITE PROCESS IMPROVED

The Bureau of Mines of the United States Department of Interior has developed a new method for processing the Stillwater, Montana reserve of 2,500,000 tons of low grade chromite ore into a grade required for war production purposes.

TVA TO PRODUCE CALCIUM CARBIDE

At a cost of $1,000,000 the Tennessee Valley Authority will convert its Number 2 nitrate plant by October, 1942 into a calcium carbide plant with an annual capacity of 70,000 tons.

CONTRACT PRICE ADJUSTMENTS

The Navy and War Departments and the Maritime Commission have established Price Adjustment Boards for the purpose of reviewing past and future contract prices and profits. They will make inquiries into war contractors earnings, operating costs, salaries and bonuses. Based on their findings they will pave the way for price adjustments, refunding of unreasonable profits and re-negotiation of contracts.

MAGNESIUM AND METALS SURVEY

The Magnesium Order M-2-b due to expire April 30, 1942 has been extended by WPB to October 31, 1942. About the first of June the WPB survey of the use of metals in raw and semi-fabricated forms during the first quarter of 1942 is expected to be completed. This survey will give the WPB not only a picture of the immediately past current metal situation, but it will also enable it to plan better production programs.

METAL PRICE EXEMPTIONS

Price Administrator Leon Henderson in Supplementary Order No. 1, effective May 11, 1942, exempted from the maximum price regulation of April 28, 1942 such commodities as zinc, lead, zinc skimmings, zinc ashes, sal skimmings, flue dust, lead drosses, lead slags, lead ashes, lead sludges, tin residue, solder, babbitt and antimony.

METAL PURCHASES FORM MEXICO

Secretary of Commerce Jesse Jones has disclosed that the Metals Reserve Company, in cooperation with the State Department, has entered into an agreement with the Mexican Government for substantial purchases of Mexican lead, copper and zinc in metallic form, ores and concentrates "at prices which should give a stimulus to increased production."

NON-FERROUS CASTING PRICES

The Office of Price Administration April 28, 1942 Maximum Price Regulation No. 125 governing non-ferrous foundry products, effective May 11, 1942, placed all casting prices on the October 1, 1941 to October 15, 1941 level. For OPA inspection and reporting purposes, the regulation provides, that every person buying or selling non-ferrous castings must keep a record of (1) the date of the transaction, (2) the name and address of the buyer, (3) the list price on the date of purchase, (4) the net amount received after discounts and other allowable deduction, (5) the quantity and description of the castings, and (6) the actual cost of production.

NICKEL SCRAP CONTROL

To find new sources of nickel and to gain complete control of nickel scrap, WPB issued Order M-6-c. This Order requires the segregation of all scrap which contains more than one half of one per cent nickel. Persons other than smelters are restricted to a 30 day accumulation of nickel scrap, provided the nickel content is less than 100 pounds. And those who produce, or have an inventory of, more than 500 pounds a month of nickel scrap must report to WPB on the 15th of each month. The Metal Reserve Company has been exempted from nickel scrap prices set by Regulation No. 2 on April 15, 1942.

PLUMBING AND HEATING EQUIPMENT

Limitation Order No. L-42, amended May 7, 1942, provides that cadmium, chromium, copper, copper base alloy and nickel may not be used as a finish for any plumbing and heating fittings and trim. Lead and zinc, however, may be used.

PATENTS TO BE SEIZED

In an effort to end the tangles which are holding up war production the Government is taking steps to seize, and to make available to American industry on a license basis, over 23,000 patents, thousands of trademarks, and countless copyrights issued or held by enemy, neutral or Allied aliens. In fact Alien Property Custodian Leo T. Crowley is of the opinion that "it may eventually be desirable to turn the patents over to a Government-owned and operated corporation which not only could administer the patents, but which also could conduct the necessary technological research to maintain and improve their value."

NEW PRIORITY FORMS REQUIRED

In the future those metal finishing industries who seek priority ratings and whose annual volume of business is less than $100,000 must now use special form PD-25x instead of form PD-25a.

QUICKSILVER AND RHODIUM

The production of quicksilver is expected to increase during the month of June. Rhodium was banned as a material allowable in the manufacture of jewelry by Conservation Order M-95 on April 18, 1942.

TIN SALVAGE PROGRAM

The Tin Salvage Institute of Newark, New Jersey was authorized to act as agent for the Metal Reserve Company in the collection and salvaging of collapsible tin, tin alloy or tin coated tubes. The Order was given by the War Production Board on May 11, 1942.

ZINC ALLOCATION CONTROL

Metallic zinc will be placed under an allocation certificate control system on June 1, 1942 by the War Production Board. Under this new system zinc dealers must use form PD-450 and consumers must use form PD-94-a in making application for their monthly allocation certificate. Effective May 11, 1942, the Office of Price Administration placed a ceiling on rolled zinc prices at the November 29, 1941 level.

GOVERNMENT INSPECTION OF CONTRACTORS' BOOKS

Since all financial books of war contractors and sub-contractors are subject to Government inspection certain principles have been laid down to determine admissible and inadmissible costs. To avoid the necessity of much worry all war contractors should familiarize themselves with these principles which are contained in a booklet entitled: "Explanation of Principles for Determination of Costs Under Government Contracts" just released by the Government Printing Office and obtainable for the price of ten cents. And since it is possible that not all will be able to get a copy because the supply may be soon exhausted therefore a brief analysis is here presented.

DIRECT SHOP COSTS

Admissible direct expenses include such shop costs as incoming transportation charges on materials, and the cost of fabricated parts and purchased materials used in the product less trade discounts, rebates and allowances.

DIRECT WAGE COSTS

Wages chargeable to the production of the product, compensation insurance, old age benefits, and social security taxes may be included under the head of direct labor costs. Allowable bonuses, special premiums and overtime payments must be kept separately.

OTHER DIRECT COSTS

Other allowable direct shop expenses are: manufacturing royalties or license fees; amortization charges on special rearrangements of plant facilities for war production, and special war production facilities; the initial cost of dies, patterns and special tools on a useful life basis; and shop engineering expenses such as the cost of professional engineers, technicians, consultants and draftsmen services directly chargeable to the product.

INDIRECT SHOP COSTS

Admissible indirect shop expenses include all such general supply and sundry material costs as fuels, lubrication, light, water, gas, compressed air, ventilation, air conditioning, heat, power, non-durable and small tools, gauges, factory office supplies, boxing and wrapping materials, welfare expenses, vacation pay, pension and retirement payments, accident compensation, normal rearrangement plant facilities costs, premiums and payments to unemployment, old age and social security funds for employees not directly connected with the execution of the war contract, and all supplies for all heat treating, plating, cleaning and anodizing operations.

OTHER INDIRECT COSTS

To these should be added the maintenance, service, stores, receiving and shipping departments indirect expenses including the wages and salaries of such employees as foremen, assistants, inspectors, machine setters, cleaners, crane operators, general laborers, oilers, timekeepers, shop clerks, stock clerks, millwrights and shipping clerks.

ADMISSIBLE FIXED CHARGES

Fixed charges which are admissible as indirect shop costs are all property insurance premiums, property and plant taxes, rentals, obsolescence, depreciation and depletion of resources.

OTHER MANUFACTURING COSTS

Under the head of other manufacturing and contract performance costs which are admissible are the amortization of patents and purchased designs, research, engineering and development expenses directly related to the war product; transport costs incurred in delivery of goods; installation and servicing costs of war products; and such sundry costs as premiums on performance bonds, state sales taxes imposed on the contractor, adjustment and test expenses, and special travelling expenses. Detailed records must be kept of these items.

ADMINISTRATIVE AND DISTRIBUTION EXPENSES

Items which may be included under the head of admissible administrative and distribution expenses are salaries of corporate officers, executives and departmental heads, administrative clerks; the payments to unemployment, old age, pension and social security funds for such employees and officials; regular trade paper advertising; office and administrative expenses; legal, accounting and consulting fees; contributions to local charitable and community organizations; dues and memberships in regular trade associations; and bidding expenses.

INADMISSIBLE COSTS

The inadmissible costs include such items as interest on invested or borrowed capital; commissions, bonuses and special premiums for negotiating contracts; entertainment expenses; dues and memberships in non-regular trade associations; donations not for local charitable and community organizations; losses on contracts; losses due to the sale or exchange of capital assets; expenses due to strikes and lockouts; fines and penalties; amortization of unrealized assets values; depreciation and maintenance costs of excess facilities; provisions for special contingency and repair reserve funds; income and excess profit taxes; bond discounts and other finance charges; life insurance premiums on officials; special legal and accounting fees due to reorganization; taxes and expenses on capital stock issues and transfers; losses on investments; bad debts; collection and exchange expenses; and general commercial advertising and selling expenses.

Plated Aluminum in the War Program

BY RAYMOND F. YATES

Vice President,
Krome-Alume, Inc.,
Lockport, N. Y.

UP until a few years ago, it was not generally conceded that aluminum could be plated with any metal except nickel, and that in a rather precarious fashion. Now, however, aluminum is being effectively plated with any one of the platable metals and during the past year a number of extremely important military uses have been discovered for aluminum covered with deposits of copper, brass, cadmium, silver and so forth.

When the Krome-Alume process first appeared a few years ago, it was rather difficult if not impossible to plate aluminum alloys directly from any one of the cyanide solutions. The anodic coating employed in the process was unduly sensitive to the alkaline solutions especially when they were operated at elevated temperatures and had a high pH. When it was attempted to plate aluminum in such solutions, the solution apparently managed to practically remove the modified anodic coating before a deposit could be obtained.

Within the past two years, these shortcomings of the process have been entirely eliminated by very simple means and it is now possible to plate directly from alkaline solutions except in extreme cases where the temperature is too high or the pH is too great. However, this condition does not hold in the common, unpatented solutions used in the deposition of copper, brass and cadmium.

The deposits of metal plated directly from cyanide solutions are just as firmly adherent to the surface of aluminum as are nickel deposits. For instance, when copper is plated, it becomes possible to effect fabrication by soldering by this means.

Cadmium Plating for Soldering Aluminum

During the past year, plated aluminum has made considerable inroads in the radio industry especially as it relates to the production of radio aircraft equipment. The object here is two-fold; there is the urgent necessity of soldering aluminum parts and there is also the matter of reducing the electrical losses in aluminum conductors when they are called upon to carry high frequency currents. It is well known that these currents travel only on the surface of conductors, and due to the oxide that is always formed on the surface of aluminum, aluminum has turned up, by actual measurement, to be a notoriously poor conductor for these high frequency currents. However, when aluminum is covered directly with silver, these electrical losses are reduced to a notable degree and for this reason a large number of new devices made of aluminum are now being covered with silver and nickel and silver. Some cadmium is also being used on the aluminum cases intended for use with electrolytic condensers.

Brass Plating Aluminum for Rubber Bonding

Another unexpected use for plated aluminum has come from the rubber industry where it has been discovered that aluminum, brass plated directly, can be covered with rubber and that the bond between the aluminum and rubber, established through the agency of the brass, is excellent. Whereas the adhesion effected by some of the best known cements

Fig. 1. In this illustration rubber was electrodeposited upon brass plated aluminum. The rubber can also be applied by molding.

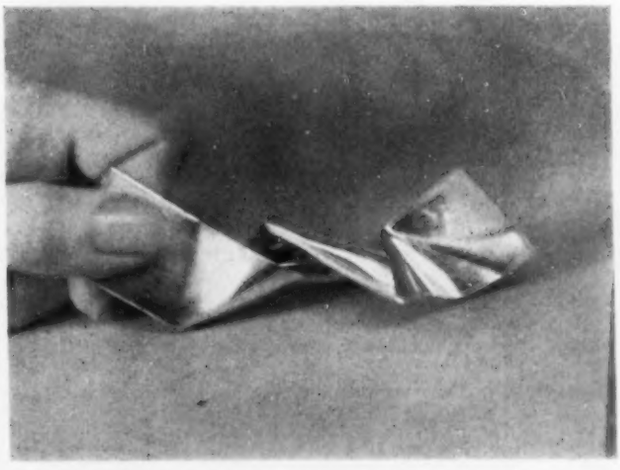

Fig. 2. A mechanically abused aluminum sheet that had been cadmium plated. The aluminum can be severely flexed without rupturing the plate.

for this purpose has a tensile strength somewhere around 700 lb. per sq. in., brass plated aluminum indicates an adhesion that will be limited only by the mechanical strength of the rubber adhered. The brass is plated out of a common type brass plating solution and the adherence is as good if not better than on some other metals.

This application of the process has already found extensive use in aircraft industry in connection with certain parts, especially those concerned with the bullet-proof aluminum gasoline tanks. In this connection it is important to point out that the brass between the aluminum and rubber is not affected by benzol as is the cement. Some of the Allied Countries are forced to dope their gasoline with benzol to increase its octane rating.

Aluminum mountings incorporating rubber will also be produced for engines and instruments. Rubber adherence to aluminum, through the medium of brass plating, is also taking other directions. A number of independent investigations are being conducted at the present time. Most of these are of a confidential nature and the details cannot be given here.

A number of investigations are also going on at the present time having to do with the deposition of nickel and chromium and hard nickel on the surface of certain aluminum airplane parts that are called upon not only to resist mechanical wear but also wear through abrasion. To date, the results have been gratifying, although it is to be pointed out that most of the alloys used for such parts are not as easily plated by means of the Krome-Alume process as are some of the alloys with lesser strength. Many of the durals run to very high percentages of other metals especially copper and the anodic coats established on the metals have never been as strong as those on the more common alloys. If one thing has been demonstrated during the past few years in connection with the Krome-Alume process, it has been that the adhesion of any deposited metal cannot be any better than the anodic coat. If the coating is thin and of poor quality, the plating will have poor adherence. However, adhesion on these metals has been established to a point where it is feasible to solder to them. It is hoped that before long adhesion on these alloys will be as good as it is in connection with the purer forms of aluminum like 2S and 3S.

Heavy Nickel on Aluminum

When the mention of nickel and chromium plated parts for wear resistance is made, it is well to consider that the decision between the newer hard nickel and chromium is yet to be made. Where ordinary chromium deposits are produced on metal cylinders that have to be lubricated while in operation, the shortcomings of chromium are present in many instances. Oils do not hold well to chromium plated surfaces although there are several processes now that may be employed for the deposition of porous chromium.† There is still the brittleness of chromium to rule against it in such applications and it would seem that there are many instances where hard deposits of metal can be employed with better effect. This type of metal is

† For example, the Van der Horst process described in *Metal Finishing*, pp. 76-78, Feb. 1940.

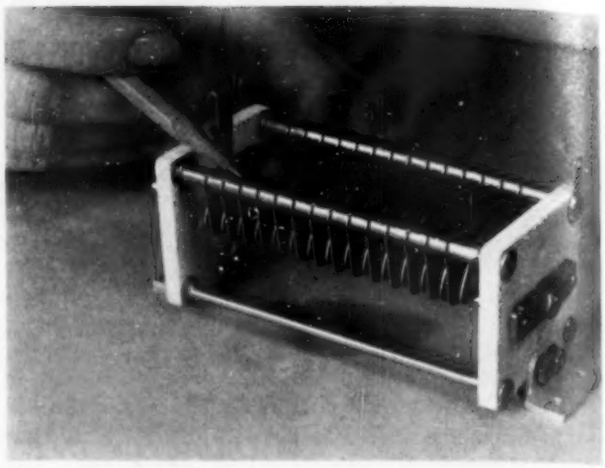

Fig. 3. Fabrication of certain radio parts is now being effected by soldering over nickel, copper and silver plated aluminum parts.

extremely hard and yet it has a reasonable amount of ductility and where the base is metal is apt to be soft, even as it is in connection with the best alloys, the leaning toward nickel can be understood. A thousandths or more of well deposited, hard nickel, on aluminum surfaces will withstand a tremendous amount of wear and it is indicated at the present time that these experiments will eventuate in finding as many uses for aluminum plated with hard nickel as for aluminum plated with hard chromium. Already nickel plated aluminum has found two applications in connection with the production of military aircraft equipment and it would seem that within the next few months a number of other applications will be discovered.

Cadmium Plate on Aluminum

Cadmium plating directly to aluminum surfaces has also found some measure of success in the defense picture and here there are also indications that the present uses of cadmium plated aluminum will expand as the war effort goes on. Cadmium plated directly to the surface of aluminum in any sizable amount is claimed by some authorities to offer as much protection to metal as does anodizing. This might be especially true in connection with the aluminum alloys containing high percentages of other metals. Instances have been known where the deposition of about a half-thousandth of an inch of cadmium has permitted the article plated to carry on in a salt spray test cabinet to a point where it almost touched 720 hours demanded by the United States government in connection with anodized material.

Where aluminum pistons are used either in gasoline or Diesel engines, it is being found advisable, especially in the case of the Diesel engine, to plate the top of the pistons with nickel to prevent excessive oxidation of the base metal. Experiments have also indicated that the pistons plated with nickel over its entire surface is able to decrease wear and preserve compression to a remarkable degree. Work with cast aluminum has also brought encouraging results and plans are now being made for the actual introduction of these surfaces on a commercial basis.

ABSTRACTS OF TECHNICAL PAPERS

Presented at

Spring Meeting of Electrochemical Society

X-RAY STUDIES OF STORAGE BATTERY PASTES

By J. N. Mrgudich

X-ray diffraction studies of storage battery pastes have yielded data susceptible of interpretation in terms of the reaction mechanism taking place during paste mixing. The first reaction is one involving the assimilation of sulfate groups into the oxide lattice without precipitation of any known stoichiometric compound of lead. The incorporated sulfate groups impart to the now modified and abnormal PbO lattice an excess potential lattice energy which manifests itself in terms of altered surface forces (adhesion and cohesion, drying qualities), increased instability and increased activity (as measured by grid corrosion during subsequent steam-drying). High paste-mixing temperatures result in destruction of the modified PbO lattice by precipitation of 4PbO. $PbSO_4$ and normal PbO.

SOLUBILITY OF NICKEL IONS IN AQUEOUS ALKALINE CARBONATE-TUNGSTATE SOLUTIONS

By M. L. Holt and D. A. Swalheim

The authors conclude that the solubility of nickel ions in alkaline carbonate-tungstate solutions is due to the effect of sodium hydrogen carbonate rather than to the formation of a soluble complex nickel-tungstate as previously suggested. The various electrochemical and solubility studies which are described support this conclusion. Sodium hydrogen carbonate is present in the solutions as a result of the action of tungstic acid or sodium polytungstates, but not of the action of normal sodium tungstate, on aqueous sodium carbonate. It is suggested that the sodium hydrogen carbonate causes the formation of either soluble nickel hydrogen carbonate, $Ni(HCO_3)_2$, or sodium dicarbonato nickelate, $Na_2Ni(CO_3)_2$. Electrolysis results support the view that the formation of the nickelate is the best explanation for the solubility of nickel in these alkaline tungstate solutions.

THE OXIDATION OF CEROUS SULFATE AT A ROTATING ANODE

By J. L. Culbertson and C. Rutkowski

The effect of anode rotation on the current efficiency of the electrolytic oxidation of cerous sulfate was studied. It was noted that the anode rotation causes an increase in the current efficiency and that the mathematical form of the relation of the latter quantity to the rotation speed is similar to that of a heat transfer coefficient of a liquid film, at a solid-liquid interface, to the speed of the fluid past the solid surface. Since the heat transfer coefficient is diffusion-controlled and its magnitude is increased by film attrition, it is concluded that the electrolytic reaction is governed in a similar manner.

PERBORATE FORMATION AT A ROTATING ANODE

By J. L. Culbertson and W. C. Teach

The effect of rotation of the anode on the electrolytic formation of perborate from borax has been investigated. Rotation speeds up to 6,055 revolutions per minute were used. It was found that the current efficiency of the reaction increased at low speeds. The increase was followed by a drop in efficiency which tended to level off at high speeds. The results obtained are examined in the light of existing theories.

ELECTROLYTIC POLISHING OF SILVER

By L. I. Gilbertson and Otis M. Fortner

Silver can be polished electrolytically by a process of anodic corrosion in a bath of silver cyanide, potassium cyanide and potassium carbonate such as is usually employed for silver plating. Careful regulation of current density is required. Room temperature is most suitable for the operation, although slightly higher or lower temperatures are equally satisfactory. Sufficient stirring to prevent layer formation is desirable, but high stirring rates are to be avoided. The reflectivity of the resulting surface appears to be as high as, if not higher than, that of a mechanically polished surface. The process depends upon the formation of an anode film which is soluble in the electrolyte under suitable conditions of current density, temperature, and free cyanide concentration.

Electropolishing affords a means whereby silver specimens may be prepared for etching and microscope examination without introducing any possibility of the production of a mechanically work-altered surface layer. After polishing, the etching may be carried out in one of the usual ways, that is, by the use of a corrosive reagent such as chromic acid or by making the specimen anode in a cyanide plating bath and etching at a low current density (0.4 amp./dm.^{2} or less).

NICKEL PLATING MAGNESIUM ALLOYS

By W. S. Loose

Magnesium alloys may be readily electroplated with adherent nickel deposits. To obtain these deposits, the basis metal, after buffing and cleaning in the usual manner, is first dipped in a bath containing 120 g./L. CrO_3 (16 oz./gal.), 112 cc./L. HNO_3 (10.4 oz./gal.) and 1 cc./L. H_2SO_4 (0.07 oz./gal.) for a period of 2 to 8 seconds and then, after thorough washing, is dipped in a solution of 10% HF and 1% HNO_3 for 1 to 5 minutes. After another washing, the magnesium alloy is electroplated with nickel in a nickel borofluoride bath containing a slight excess of boron and 3 to 7 g./L. of fluorine over that required to form $Ni(BF_4)_2$. The deposits may be readily buffed to a high finish and chromium plated. Electroplated nickel on magnesium alloys has good adhesion and stands up well in indoor atmospheres, but is not recommended for moist corrosive conditions, due to porosity of the plate (no matter how slight) and the high contact potential difference between magnesium and nickel, which in the presence of moisture is a cause of electrochemical corrosion.

NEW WORK ON TIN PLATING FROM AMMONIUM STANNOUS OXALATE

By Frank C. Mathers and Paul H. Johnson

Hydrolyzed glue, prepared by boiling 10 g. of glue in 100 cc. of water for 10 hr., is as good an addition agent as peptone in the ammonium stannous oxalate plating bath. This hydrolyzed glue costs less and is less subject to bacterial decomposition than peptone.

Many different addition agents and combinations of these were tried but none was equal to this hydrolyzed glue.

Glue alone gives good deposits and it is not necessary to add pyrogallol, or the iodide or sulfocyanate, although these compounds will improve the tin deposit somewhat.

The deterioration of the tin oxalate bath is caused by the oxidation of the stannous ions to stannic.

There is less oxidation of stannous ions if spongy tin or tinfoil

is used for the anodes instead of cast tin.

A deteriorated or oxidized bath can be regenerated by boiling it with spongy tin for 1.5 hr. Standing at room temperature in contact with spongy tin will not bring about reduction of stannous ions.

A cathode current density of 0.4 amp./dm.^{2} (3.5 amp./sq. ft.) was used in these experiments. However, a cathode current density as high as 2.7 amp./dm.^{2} (25 amp./sq. ft.) can be used for thin deposits. The current density at the anode should be low, 0.4 amp./dm.^{2}, to avoid gassing.

The bath gives best results at room temperature.

A further advantage of this oxalate bath is that the materials for making up the bath are generally available in most laboratories, and there is no difficulty in the preparation of the bath.

THE RATE OF FILM FORMATION ON METALS

By Benjamin Lustman

The experimental results on the rate of formation of thin reaction product films on metals are critically reviewed and compared with results on the rate of growth of relatively thick reaction products or scales. The two processes of film and of scale formation are shown to be essentially different with respect to time and temperature effect on rate of formation. An exponential equation is found to apply to the growth of certain films, and a parabolic equation to that of others. Characteristic minima are exhibited in the temperature variation curves of film formation rate. The surface structure of the metal, the orientation of the underlying metal crystals, the structure of the reaction products, and the magnetic state of the metal are found to affect the rate of film growth anomalously. The various theories of film growth are critically discussed on the basis of these experimental facts and the inadequacies of each theory are pointed out.

THE RATE OF OXIDATION OF COPPER AT ROOM TEMPERATURE

By Addison H. White and Lester H. Germer

Electron diffraction was used to measure the rate of the reaction between copper and pure dry oxygen at room temperature and 20 mm. pressure. The experimental technic is described in detail. The empirical rate of reaction is found to be inversely proportional to $(t + c)$ for the time t greater than two minutes; the constant c is experimentally indistinguishable from zero but must be finite. It is estimated that the local thickness, x, in Ångstrom units of the oxide film increases according to the equation: $x = 4 + 6.5 \log_{10} t$ where t is measured in minutes and is greater than 2 min. A limiting film thickness of about 50 Å is predicted by this equation.

STUDIES ON OVERVOLTAGE. XI. SOME UNUSUAL OVERVOLTAGE PHENOMENA

By A. L. Ferguson and H. Bandes

This is the first report on a series of researches in which an intensive study is to be made of factors related to overvoltage, so as to get a better insight into the mechanism of electrode potential and overvoltage. A list of questions concerning electrode potentials and overvoltage is given; also a list of possible stages in the process of ion discharge. Equipment is briefly described for obtaining the oscillograms shown of rapid changes in electrode potentials. Peculiar maxima in the *IR* and cathode curves are discussed; the oscillograms presented show the influence of previous charge, current densities, and time of charge on these maxima. Agitation of electrolyte affects charge and discharge potentials. The results obtained can be explained if it is assumed that the back potential is due to the liberation through discharge at the electrode, even at the lowest applied potentials, of a sufficient amount of active material to set up a back potential equal to the applied potential, and that a part, at least, of the continuous current is required to replace that portion of the active material continually lost by diffusion or otherwise.

STUDIES ON OVERVOLTAGE. XII. LONG TIME CHARGE AND DECAY PHENOMENA

By A. L. Ferguson and H. Bandes

This paper presents additional material, obtained with practically the same equipment as described in Part XI, and deals largely with long time charge and decay curves for anode, cathode, and total cell potentials when cells are polarized to different current densities. The curves show that the charge and discharge processes are complex in nature, yet fairly reproducible. The fundamental nature of the processes appears distinctly different for anode and cathode, yet for each electrode the variation with current density is not pronounced. A fairly consistent qualitative effect due to agitation of the solution is observed. Much of the material presented supports the contention stated in previous papers that cathode overvoltage is due to more than one factor and that the same explanation cannot apply to both anode and cathode; also, that the most important point is the discharge of ions at the electrodes even at the lowest applied potentials. Breaks are observed in both charge and discharge curves at approximately 1.23 v. and 1.58 v., which are respectively the theoretical potential of the oxygen-hydrogen cell and the observed decomposition potential of water.

ELECTROPHORETIC DEWATERING OF CLAY

By Sidney Speil and M. R. Thompson

The electroosmotic dewatering of both electrodialyzed and undialyzed clay was studied to determine the yield per faraday, the energy consumption per ton of dry clay, and the moisture content of the deposit. The effect of temperature, time of deposition, current density, electrode spacing, solids concentration, conductivity, type and amount of dispersant, and type of electrode were determined. The applications of Ohm's law to general machine design and of fundamental electrokinetic concepts to the dewatering process are discussed. These concepts complement the strictly electrochemical relations and are necessary in the study of clay, which does not have a fixed equivalent weight. An empirical equation is given which allows the determination of the "apparent current efficiency." Data on the dewatering of several clay types are summarized.

DECOMPOSITION OF AQUEOUS AMMONIUM CHLORIDE SOLUTIONS

By C. B. F. Young and Earl G. Lundstrom

It is possible to electrolyze an aqueous solution of ammonium chloride and obtain thereby ammonia, ammonium hydroxide and chlorine provided the solution contains appreciable amounts of sodium chloride. The cell used can be a cylindrical unsubmerged vertical perforated sheet steel cathode type having graphite anodes and asbestos diaphragm. Anode current density should be in the neighborhood of 14.47 amp./dm.^{2} (134 amp./ft.^{2}) while the cathode current density should be 11.02 amp./dm.^{2} (102 amp./ft.^{2}). The solution should be 50-75° C. Under these conditions the actual anode current efficiency was 81.1%. However, 36.3% of the chlorine liberated formed side reactions. The cathode current efficiency was 84.3%. It is indicated that the anode efficiency can be increased by increasing the sodium chloride present. Explosions occurred in some cases, but it is felt that this was due to faulty construction of the cell or to too low a temperature.

THEORY OF OXIDATION AND TARNISHING OF METALS I

The Linear, Parabolic and Logarithmic Laws

By H. A. Miley

Theoretical considerations are given to the discovery, some twenty years ago, of the three laws governing the corrosion of some common metals, the development of their equations, and the constants in the equations. The logarithmic law was really discovered in 1922, a year before the discovery of the linear and parabolic laws, but it was not until after its rediscovery in 1939 that explanations became available for an increasing number of discrepancies. An electrochemical interpretation of the ionic theory provides a basis for developing the equations of these laws. The diffusion theory had never provided an adequate explanation of the parabolic law. The ionic theory postulates the movement of cations and electrons outwards and of anions inwards across the growing film, and the electrochemical interpretation of this theory makes it theoretically possible for a continuous film to obey two or more of these laws by turns. The growing film may be compared with a current-producing cell, the requirements for changing from a parabolic growth rate to a logarithmic rate being provided by polarization. The critical

film thickness, beyond which polarization may be expected, is influenced by all of the factors that affect the perviousness of the film. The linear law may be obeyed sometimes when the resistance of the film is small enough to permit the mechanics of the film building process to control the rate of growth. Some results from the literature are discussed in the light of this electrical theory.

THIN OXIDE FILMS ON IRON

By E. A. Gulbransen

A vacuum microbalance technic for the study of the chemical reactions occurring on metallic surfaces is described. Preliminary curves are presented for the oxidation of pure electrolytic iron from 25° C. to 400° C. and at various pressures of oxygen. Attempts are made to correlate the data with the various mechanisms proposed for oxidation reactions. A suggestion is made that the overall rate may be thought of as a sum of three individual rates. These are: (1) a rapid initial rate; (2) an intermediate reaction which involves the logarithm of the difference between an extrapolated parabolic law and the experimental value as a function of time; and (3) a parabolic law which is found to hold above a certain temperature and film thickness.

CORROSION OF BINARY ALLOYS

By Ralph Landau and Carl S. Oldach

Corrosion and potential studies under controlled conditions are reported for the binary systems Fe-Ni, Fe-Co, Fe-Mn, Ni-Cu, Ni-Co, Ni-Mn, Ni-Ta. Data from the literature on these and other binary solid solution alloys have been collected and critically examined. The passivity of these alloys is discussed in relation to the influence of the corroding medium, the nature of the pure metals, etc., and the practical importance of passivity limits is noted. Passive metals in alloys are contrasted with noble metals. Regularities with respect to position in the periodic table, and minima in the corrosion-compositoin curves are observed, both of which are of possible practical importance.

CONCLUSIONS

1. The metals such as Cr, Mo, W, Ta, V, Ni, Co, Rh, Ir, confer corrosion resistance on other less resistant metals (such as Fe, Mn, Cu) because of their passivity in relatively oxidizing media. Frequently only a comparatively small amount of these metals is required to bring about an alloy resistance to corrosion virtually equal to that of the pure passive metal.
2. Passivity is a relative term, and the passivity limits vary more or less widely with the medium and the nature of the active metal, but fluctuate over a reasonably narrow range in many media.
3. There seems to be a marked difference between the passivating influence of metals like Cr, Mo, W, etc., and the lesser improvement in corrosion resistance due to dilution with a noble element like Pd.
4. There is a general correlation of passivating effect with position in the periodic table. The 6th group, Cr, Mo, W, shows the strongest influence, and there is a tapering off to either side. The noble metals show little passivity.
5. Atomic percentages are necessary to compare the corrosion of alloys, but weight percentages determine the cost of the alloy. The atomic weight of a passive metal must therefore be considered in studying new alloys.
6. Minima in the curves of corrosion *vs.* composition appear in many systems under varying conditions, and appear to be due to the intrinsic effect of alloying.
7. In the stronger non-oxidizing acids, the beneficial effects of passivity largely disappear, and other factors determine the corrosion of alloy systems.

ELECTROLYTIC BEHAVIOR OF FERROUS AND NON-FERROUS METALS IN SOIL-CORROSION CIRCUITS

By I. A. Denison

Measurements have been made on the behavior of a variety of metals exposed to corrosion in soils having widely different chemical and physical properties. The metals studied were low-carbon steel, two varieties of stainless steel, copper, low-copper brass, zinc and lead. A specially designed corrosion cell, previously used in studying the corrosion of steel, was employed. With the more corrodible metals, such as steel and zinc, and other metals in certain environments, the cell develops its own e.m.f. For measuring the corrosion rate of these metals for comparison with the results of field tests, the current required to bring the electrodes of the corrosion cell to the same potential was selected. For all other materials and environments in which the corrosion cell did not develop a definite polarity, the minimum current required to protect the cathode of the cell from corrosion was taken as equal to the corrosion current. The current corresponding to the equipotential value, *i.e.*, the corrosion potential, was found to be equal to the protective current when the rate of corrosion is determined by the reaction at the cathode.

The rates of corrosion of the metals in the different soils were in agreement with the results of the field tests to the extent that both series of tests indicated whether or not the materials were seriously corroded in the different soil environments. Zinc, however, which was corroded more rapidly than steel in the laboratory, was more resistant to corrosion than steel in the field tests. The relatively greater corrosion resistance shown by zinc in the field tests is attributed to the partial suppression of anodic areas by cathodically formed alkali. The corrosion rates obtained with the corrosion cell might be taken to indicate the behavior of zinc as a separate anode in a bimetallic circuit, as in the cathodic protection of steel by zinc.

The electrode at which the corrosion rate is controlled was determined for the different materials and environments by observing current-potential curves of the separate electrodes. The rates of corrosion of steel and zinc under most soil conditions are controlled by the reaction at the cathode. However, in very porous soils, particularly those strongly alkaline in reaction, the control shifts to the anode. The corrosion of copper, brass and stainless steel, which in most soils is controlled anodically, is controlled by the cathode in poorly aerated organic soils which contain high concentrations of soluble salts, indicating that the normally protective oxide film has been destroyed. For lead, however, the shift of control is in the opposite direction, becoming anodic in the presence of soluble salts because of the formation of a protective film of corrosion products at the anode.

ANODIC AND SURFACE CONVERSION COATINGS ON METALS

By Junius D. Edwards

The widespread application of anodic and surface conversion coatings on metals is demonstrated by this discussion of protective coatings on aluminum, magnesium, zinc and iron. Aluminum is unique in many ways, in its chemical and electrochemical behavior, and the anodic treatment of aluminum has reached an advanced stage of development. A detailed study of the chemical and electrochemical coating of aluminum is therefore helpful in connection with other metals. Not only for the role they play alone but for the part they play in promoting paint protection and adhesion, are these surface coatings proving indispensable to the user of metals.

CATHODIC PROTECTION

By R. H. Brown and R. B. Mears

If the corrosion is electrochemical, it may be concluded from this work that:

1. In order that protection may be complete, the potential of the cathode areas must be polarized to a potential equal to or more anodic than the open circuit potential of the anodes.
2. In order that protection may be complete in solutions where the cathodic polarization is large compared with the resistance drop, the cathode must be polarized to the open circuit potential of the anodes.
3. In order that protection may be complete in solutions where the cathodic polarization is small compared with the resistance drop, the cathode must be polarized to a potential more anodic than the open circuit potential of the anodes.
4. The current required for complete protection will depend upon the current required to polarize the cathode to a potential equal to or more anodic than the open circuit potential of the anode.
5. The current required for complete protection will depend upon

the position of the auxiliary anode relative to the position of the local anodes and cathodes.

6. The less the potential drop between the auxiliary anode and the local cathodes, the less the current required.

7. Special attack or inhibition may be produced by the products of electrolysis resulting from the application of cathodic current.

8. Special attack on surfaces which are made cathodic may be beneficial if the type of attack is also altered.

SINGLE METAL, BINARY AND TERNARY ALLOY DEPOSITION FROM THIOSULFATE SOLUTIONS

II. Binary Alloy Deposition of Copper-Nickel, Copper-Cadmium and Copper-Zinc Alloys from Thiosulfate Solutions

By D. C. Gernes and G. H. Montillon

Abstract

Results are presented of an investigation to determine the conditions required for the deposition, from thiosulfate solutions, of binary copper alloys having a wide range of copper content. The variation of the copper content of the deposit with current density and the copper content of the bath was determined quantitatively for copper-nickel and copper-cadmium alloy deposits, whereas the effect of agitation, temperature and other changes in bath composition were investigated only qualitatively. A few data were also obtained on the cathode current efficiency and sulfur content of the deposits. In the deposition of the copper-zinc alloys, the principal effects studied were those of bath temperature and current density on the copper content of the deposit. Recommended bath composition and plating conditions are given for the deposition of copper-zinc alloys having the color and copper content of the ordinary yellow brasses.

"NULL" METHODS APPLIED TO CORROSION MEASUREMENTS

By J. M. Pearson

The use of null methods to eliminate *IR* drops from measurements of electrode potential in the presence of polarizing current furnishes a new tool for corrosion studies. When *IR* drop corrections are made in the null circuit by using a.c., polarization potentials are measured to the outside of the "electrode boundary." When increments of d.c. are used instead of a.c., the effects of film resistance are also nullified. It is possible to measure the film resistance directly. Following Müller's picture of the local action theory preliminary results indicate that the two polarization curves and the film resistance curve may furnish us criteria from which the amount of local action current can be calculated. Arguments in favor of such measurements are given, along with results of experiments.

THE EFFECT OF HYDROCHLORIC ACID PLUS INHIBITOR ON THE CORROSION RESISTANCE OF 18/8 STAINLESS STEEL

By H. H. Uhlig and E. M. Wallace

It is common practice to improve the corrosion resistance of 18/8 stainless steels by so-called "passivation" in nitric acid. The improvement is not unique to oxidizing acids because it is shown that surface treatment with hydrochloric acid, 3*N* to 12.5*N*, containing an inhibitor accomplishes much the same thing.

A commercial pickling inhibitor and quinolin ethiodide were the inhibitors tried. Corrosion resistance was determined by exposure to 10% ferric chloride, noting weight loss and number of pits. The number of pits per specimen approximately paralleled the weight loss.

Improvement in corrosion resistance was better for specimens surface-treated with the higher concentrations of acids, except 12.5*N* hydrochloric acid. The latter produced the same or lower resistance to pitting as compared with 9*N* acid. Improvement upon using hydrochloric acid plus quinolin ethiodide was less but comparable with the improvement by nitric acid.

It appears plausible that "passivating agents" for 18/8 including nitric acid improve 18/8 not by increasing the thickness of a supposed protective oxide film, but by preferential solution of anodic areas, thereby forming a metal surface electrochemically homogeneous and free from pit nuclei. This preferential solution of surface metal is accompanied by mild etching which smooths and brightens, hence improves the appearance. Oxidizing acids and anodic treatment in addition to equipotentializing the surface remove interstitial hydrogen, which when present may be a barrier to maximum passivity of the alloy.

FERRO-ALLOYS IN AUSTRALIA AND NOTES ON OTHER METALLURGICAL DEVELOPMENTS THERE

By Frank R. Kemmer

A new ferro-alloy industry has been inaugurated in Australia. Heretofore ferro-alloys and other electric furnace products were imported from abroad. Details are presented covering the Australian production of ferromanganese, ferrosilicon, ferrochromium, tungsten metal powder and tungsten steels. Brief notes are appended on calcium carbide, magnesium metal and elemental phosphorus production in Australia.

SOME MECHANISMS OF ALLOY CORROSION

By Ralph Landau

The experimental data reported in the preceding paper are examined with a view toward clarifying the mechanism of alloy corrosion. The local cell theory, in an extension to alloys proposed by the author, gives a plausible explanation for the data. It is indicated that electrochemical factors external to the metal are chiefly responsible for the behavior of alloys in non-passivating media. In passivating media, the corrosion is largely a function of film stability, and the alloy electronic structure may be of importance. Due to the complexity of the variables affecting alloy corrosion, it does not seem advisable at this time to place emphasis on phenomena within the alloys, as is done by the theories of Tammann, Russell, Uhlig and Wulff, and others.

THE PARABOLIC AND LOGARITHMIC OXIDATION OF COPPER

By A. L. Dighton and H. A. Miley

A study of the growth of oxide films on abraded copper surfaces, made from measurements obtained by the electrolytic reduction method, shows that copper may oxidize parabolically over a limited thickness range and then change to a logarithmic growth rate. The parabolic growth is expressed by the equation $y^2 = Kt + A$, where y is film thickness, t is time, and K and A are constants. After the rate of growth becomes logarithmic, it is expressed by

$$y = k \log [a(t + t') + 1]$$

where y is film thickness, t is time, and k, a and t′ are constants. Thus it appears that copper, which has been quoted often as a metal that is typical of parabolic oxidation, may also oxidize logarithmically. The results are discussed in the light of an electrical theory which provides conditions that may permit a parabolic oxidation rate for ordinary thickness ranges and require a logarithmic rate for the more advanced ranges.

Metallizing of Milk Can Washing Equipment

ONE phase of a modernization program carried out at the plant of the Lathrop-Paulson Company, in Chicago, manufacturers of milk can washing machinery and conveyors, was the installation of equipment for blast cleaning and metallizing.

Formerly certain parts of the can washing machinery were sent out to commercial galvanizers for hot galvanizing. With the new equipment a coating of pure zinc is given to all moving parts and to the framework, assuring the complete elimination of any chance of rust spots developing which might start deterioration of the iron; and the work is done in the company's own plant—an added advantage.

The growth of the business had developed to a point where the trucking of large and heavy pieces back and forth to be galvanized had become a considerable nuisance, causing much confusion and delay, damage to parts during loading and unloading, and often resulting in disruption of assembly schedules. It therefore became necessary to install equipment in the L-P plant for giving proper rust resistant treatment. Metallizing was decided upon as offering the best results in wear resistance and rust proofing, since in metallizing the thickness of the coating can be definitely controlled, and, when properly done, the adhesion is good. Then, too, the work to be metallized is not subjected to high temperatures which might cause distortion and warpage.

Special Rooms Built

Provision, however, had to be made for housing the equipment. Two well built rooms, side by side, and each 10 x 25 ft. were therefore constructed within the plant building and against one of the outer walls, where windows provide ample light. Each room is well ventilated with a 30-in. exhaust fan. One room is used for grit blast cleaning, and is lined with blue annealed sheets which protect the walls

(*Concluded on page* 305)

Fig. 1. Corner of the blast cleaning room. Preparing a section of the frame work for metallizing.

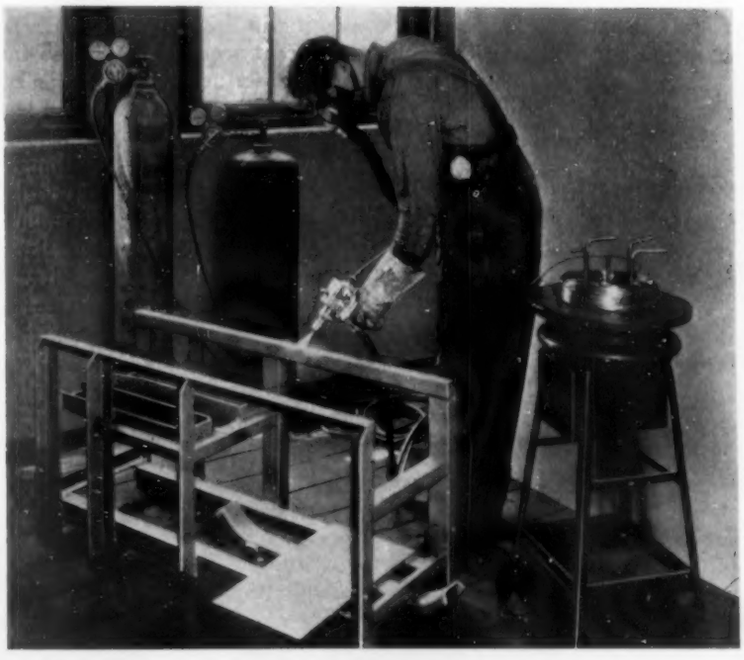

Fig. 2. Spraying a frame section with a coating of pure zinc.

Temperature Control for Chromium Plating

BY L. B. LUMPKIN

Instrument Engineer, The Bristol Company
Waterbury, Connecticut

DESPITE the classification of chromium as a strategic material and its shortage in the present emergency, chromium plating is assuming an ever increasing importance. Decorative plate, of course, has been curtailed sharply, but industrial applications for wear resistance, corrosion and salvage, are increasing daily. This article is essentially a discussion of the importance of temperature control in chromium plating, presenting a description of equipment used for this purpose.

Although commercial chromium plating as a widespread industrial process is fairly recent, the earliest records of electrodeposition of chromium date back to the middle of the nineteenth century. A number of sources credit R. Bunsen in 1854 with the earliest work, although there seem to be almost as many "firsts" as there are writers on the subject.

It was not until 1924, when the process developed by Prof. C. G. Fink of Columbia University was introduced to the industry, that modern chromium plating got its start. It is needless to say that since that time, it has advanced by leaps and bounds. Having passed through the stages of being a mysterious secret and an art, it has now emerged a highly developed technical process based on sound scientific principles and subject to very accurate checks and controls.

The phenomenal growth of chromium plating in the past sixteen years and its adaptation to many different products from airplanes to toilet articles, is testimony to its usefulness, durability, and decorativeness.

Applications and Processes

The applications may be divided roughly into two classifications. The first and earliest application is generally referred to as "Decorative Plate." The second, and at the present time the most rapidly expanding classification, is "Industrial or Hard Plate."

In decorative chromium plating, a relatively thin coating, 0.00001″ to 0.00002″, is commonly used. The purpose of this coating, usually applied over underlying coatings of copper and nickel, is twofold: first, as a protection against tarnish, and second, for color and appearance. Examples of this type of work are plumbing fixtures, kitchen utensils picture frames, buttons, and automobile trim.

Industrial or hard chromium plating is a little publicized but increasingly important field. In this application much thicker coatings of chromium are employed, usually from 0.0005″ to 0.005″; sometimes more. In many cases important savings and better products have been obtained by

L. B. Lumpkin

chromium plating. For example, with tool-steel dies used for cold drawing of wire, it was found that their useful life was increased twofold, that higher speeds of drawing could be utilized, and that the finish of the final product was definitely superior.

Also important is the use of chromium plate to decrease friction and thus increase the useful life of bearing surfaces. Heavy chromium plating is being used successfully to make equipment resistant to the action of highly corrosive solutions in the chemical industry.

Any list, however brief, of industrial applications of chromium plating would be incomplete without mention of the relatively new but ever increasing use of this process in salvage operations. This consists of building up parts or surfaces to a specified size or tolerance where through a mistake, a part has been machined offsize, or through use, it has worn beyond the tolerance limits. Today, the use of much relatively inexperienced machine-tool labor and the closer tolerances required on machined parts has resulted in the spoilage of many pieces. The salvage of these parts by chromium plating results in the saving of many pounds of strategic materials, many critical, skilled man-hours, and most important, time in delivery schedules. The importance of these savings to our war effort cannot be overestimated.

In chromium plating, the bath consists of chromic acid with the addition of the sulfate radical. Other anions such as fluoride, fluoborate and fluosilicate have been suggested.

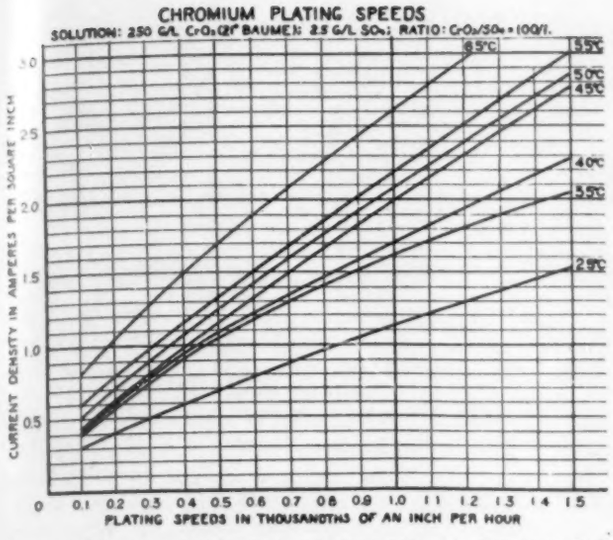

Fig. 1. Curves showing plating speeds for a 250 g./l. chromic acid plating solution at various current densities and temperatures.

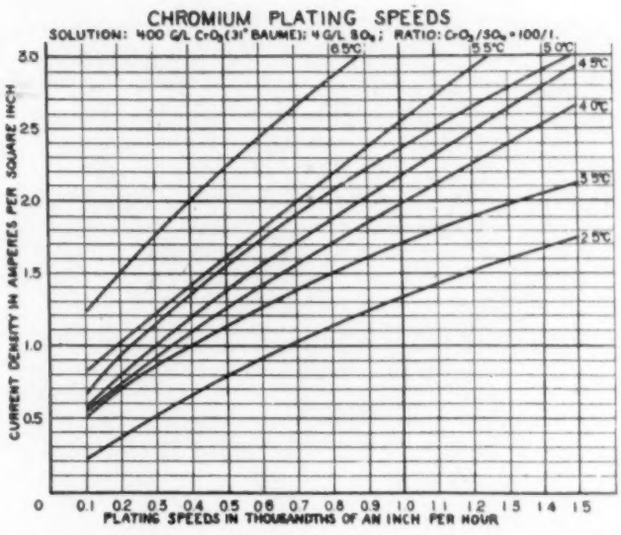

Fig. 2. Curves showing plating speeds for a 400 g./l. chromic acid plating solution at various current densities and temperatures.

(Reprinted from Transactions of Electrochemical Society.
Preprint 80-24, October 6, 1941.)

There are various compositions in use in the industry today, but most of them contain chromic acid and sulfate and are maintained at a ratio of approximately 100 parts of chrome to one part of sulfate by weight. The low-voltage, direct current used in chromium plating is regulated to supply a definite amount of current (amperes) per unit of work plated (cathode). This is called current density and for industrial chromium plating is usually from one to three amperes per square inch. With a given bath composition, the characteristics of the deposit as well as the rate of deposition can be controlled within definite limits by controlling the current density and the temperature of the bath.

The control of temperature in chromium plating baths is as important as the control of current density or bath composition, since all three factors influence the plating results. Thus with a bath in proper chemical balance and with a given current density, any variation of temperature will affect not only the appearance of the chromium deposit but also the rate of deposition. Rather than emphasize the effect of temperature control upon the finished product, it is intended primarily to describe the methods of control; and for this purpose the types of chromium plating equipment are discussed briefly.

The direct current, usually from 3 to ten volts, may be supplied by batteries, generators, or rectifiers, and may be controlled by a variable resistor such as a rheostat.

Baths are most frequently contained in steel tanks lined with 7 per cent tin-lead or 6 per cent antimony-lead. There is some advantage however, to the recent practice of lining tanks with acid-resisting ceramic block or brick joined with acid proof cement. Anodes are usually made from one of the lead alloys mentioned above.

In general the temperature of the bath is controlled by one of two methods. One method is to surround the outside of the tank with a water bath, maintained at constant temperature; the other is to place inside the bath itself a lead coil through which steam or water may be forced. The latter method is preferred since it permits rapid heating or cooling of the plating solution and eliminates lengthy shutdown periods for temperature adjustments. Also, the second method is much more adaptable for automatic temperature control, which is very popular in the trade.

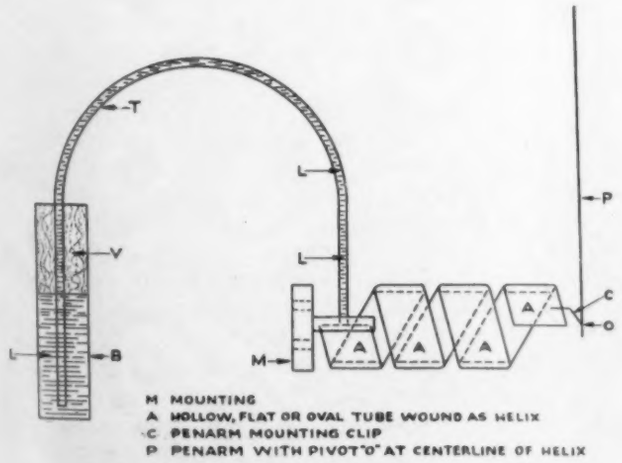

Fig. 3. Vapor tension thermometer system.

A—Hollow helical tube
B—Bulb
C—Pen-arm clip
L—Liquid
M—Tube mounting
O—Pen-arm pivot
P—Pen-arm
T—Capillary tube
V—Vapor

Temperature Control

Temperature control of plating baths may be accomplished by using an indicating thermometer and operating the steam and water valves by hand, thereby controlling the flow of the heating or cooling medium within the coils in the plating bath. This method is neither so reliable nor efficient as automatic control. From the standpoint of the cost of labor, steam, and water, it is much more expensive, and in addition, the uniformity of plating from baths equipped with automatic temperature control is superior to that of manually controlled baths. Automatically controlled baths fall into two general classifications: Those which

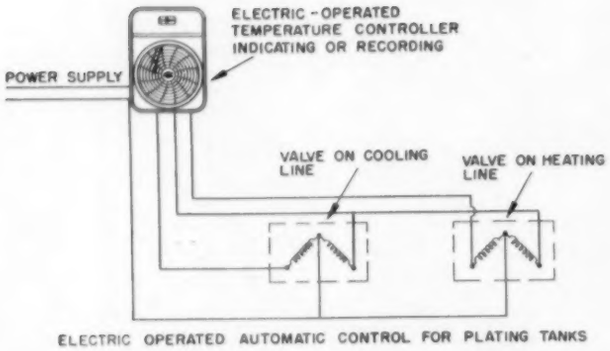

Fig. 4. Electrically operated automatic control for plating baths.

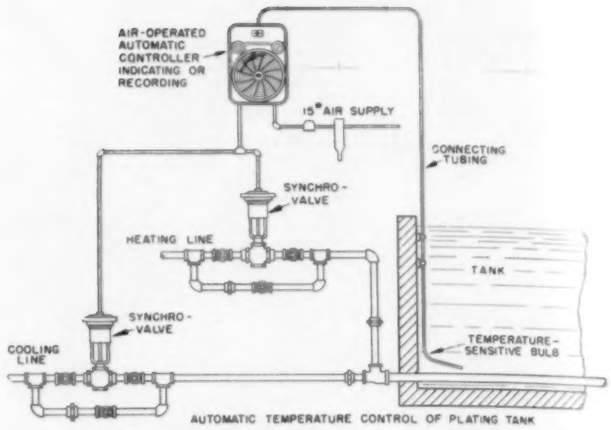

Fig. 6. Air operated automatic control for plating baths.

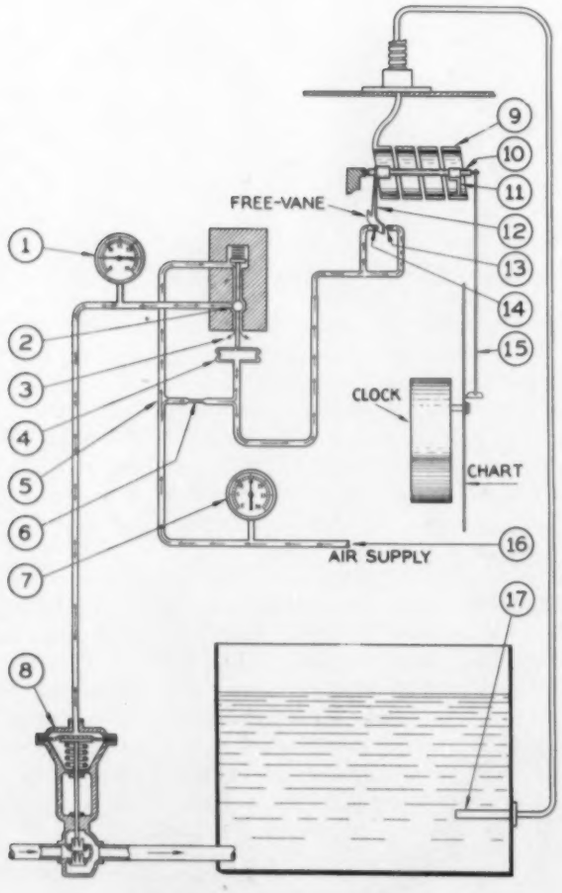

Fig. 5. Simplified drawing of the free-vane control system.

1. Pressure gauge
2. Three-way pilot valve
3. Opening at stem
4. Diaphragm
5. T connection
6. Orifice
7. Pressure gauge
8. Air operated diaphragm valve
9. Measuring element
10. Shaft
11. Connection to shaft
12. Thin metal vane
13. Air jet
14. Air jet
15. Pen-arm
16. Air supply
17. Temperature bulb

have controls on heating only, and those which have controls on both heating and cooling.

In describing the equipment for automatic temperature controls, perhaps a word about thermometer systems themselves would be in order. Although other types are occasionally used, the most popular type of thermometer system for plating baths is the vapor tension thermometer.

This consists simply of a sensitive bulb (B) (Figure 3) partially filled with a volatile liquid, which is connected by tubing (T) to the helical pressure spring (A); both of which are also filled with the volatile liquid. As the temperature of the bulb (B) rises, the vapor pressure of the gaseous phase of the liquid contained in the bulb increases to the vapor pressure of the liquid at the measured temperature. This pressure is transmitted by the liquid in tube (T) to the helical pressure spring (A) which indicates, records and actuates the control mechanism. If the temperature falls, the reverse of the above takes place. In chromium plating baths, the bulb and a portion of the sensitive tubing is covered by lead alloy to protect it from corrosive action of the bath. The range is usually from 60° to 150° F.

Temperature controlling instruments for these baths may be of the Recording-Controlling type or of the Indicating-Controlling type. Controls may be divided into two general classifications: electrically operated, and air-operated. In the first group there are controllers with temperature measuring systems, as mentioned above, which actuate electrical contacts at adjustable control points to open or close electrically operated valves on the steam or water lines. These controllers may be of the simple direct solid-metal contact type where the indicating pointer on the helical pressure spring makes a direct contact with contact surfaces for the high and low control pointers. This controller has the advantage of being inexpensive and simple.

The electric control may also be of the mercury switch type, where a motor driven feeler mechanism determines the position of a temperature indicating arm and operates mercury tube switches for energizing electric control valves. This type of instrument is also available in indicating control, which has the advantage of being more accurate: in addition, it has switches that carry sufficient current to eliminate the need of relays between the controller and the valve.

With either of the above controllers, motor driven or

solenoid valves are connected to the instrument to turn on and off the steam or water to the coil in the plating bath. The former have the advantage of longer life and perhaps more dependable operation, while the latter have the advantage of somewhat lower initial cost. Figure 4 shows a schematic layout of electric controllers for plating baths. If control for heating only is desired, the valve in the water line may be disregarded.

The second classification of controls are air-operated and are also available in both indicating and recording types (Figure 5). In one type of air-operated control, there is attached to the helical pressure element (9) a thin metal vane (12), which as the control point is reached, passes between two diametrically opposed air jets (13 and 14). As the vane moves between these air-jets, a back pressure is built up in the expansion chamber (4) which expands and raises the stem (3) and ball (2) of the pilot valve, shutting off air supply to the air-operated diaphragm valve (8) and allowing the air from (8) to escape below the ball and around the stem (3). This closes valve (8) and when the temperature drops a little, the vane will move out of the jets, lower the back pressure and allow more air to flow to the valve (8). In the case of heating and cooling control two valves are used, one of which opens with pressure on the diaphragm and the other closes with pressure on the diaphragm.

One advantage of this type of control is that the valves are not always completely open or closed; they throttle between these positions, allowing a varying amount of either control medium to flow, thus accomplishing a more accurate control. Figure 4 shows a schematic layout of air operated temperature control for chrome plating baths. Although there are many exceptions, it may be stated in general, that air operated controls give less trouble, require less frequent maintenance and are somewhat more accurate than any other. Air operated controls are recommended where a clean, constant supply of compressed air of at least 15-lbs. pressure is available. However, it must be stated that when compressed air is not available, electric controls will operate well within the temperature tolerances required. They have proved satisfactory in hundreds of installations.

To summarize, the accurate control of temperature in chromium plating baths is essential to uniform deposition and consistent results. The use of automatic temperature controls has become an economic necessity because of the increased labor costs involved in hand control and the cost in time and materials of spoilage resulting from improper temperature control. Recording temperature control has much to recommend it since a permanent record of temperature affords a very convenient means of reviewing procedure when trouble has occurred. Accurate and dependable temperature controls are available in both the electrically and air operated types and their application to new or existing installations is neither difficult nor expensive.

METALLIZING OF MILK CANS

(*Concluded from page* 301)

and ceiling against wear otherwise resulting from the grit blast. The other room is used for metallizing and is lined with ply-wood. The ceilings are 10 ft. high and each room has tight-fitting overhead doors, so that dust and odors cannot escape into the main shop area.

PARTS to be metallized are first thoroughly cleaned of all rust, grease, and dirt by blasting with No. 50 steel grit, after which any accumulations of dust are blown off with clear air. Thereupon they are moved into the metallizing room, care being taken to keep the surfaces free from foreign matter. The workmen handling the pieces from one room to another wear gloves so that no oil or sweat spots are left on the surfaces, which would prevent the zinc from adhering. For metallizing, ⅛-in. pure zinc wire is used with oxygen and butane gas. A 2-cylinder, 100-cu. ft., 80-lb., 25-hp. motor-driven air compressor, equipped with an air separator, supplies the air to the metallizing gun, the grit blasting unit, and to the helmets worn by the operators—the air supplied to the helmets, however, being at a reduced pressure.

Heavy Coatings Applied

The company makes several types of machines, some considerably larger than others, that automatically move the milk cans through the successive steps of cold and hot water, steam, acid wash, rinse, sterile rinse, steam sterilizer, and hot air drying—loading and unloading taking place on the larger machines at opposite ends, while the smaller (rotary) machines provide for loading and unloading at the same point. All machines are of heavy, sturdy, rugged design. Necessarily, many of the pieces to be metallized are large and heavy. The frame of one type is several feet wide by 22 feet long, consisting of steel angle and channel side and end members, together with numerous cross pieces and heavy steel legs on the base frame, the entire assembly being of welded construction. The standard thickness of the coating on these machines is 0.006″, which is considerably heavier than formerly when galvanized, and presents an important improvement in the product, since many parts in can washing machinery are subjected to corrosive influences and to mechanical wear. Certain parts require a heavier coating, which now can easily be accomplished. Before metallizing, rubber plugs are inserted in plain and tapped holes, thereby later eliminating the necessity of reaming or tracing to free them of zinc.

The interiors of all tanks of the machines are metallized to prevent rust formation at the arc-welded seams. In fact, all parts are sprayed with molten zinc, except a part of the housing and the pipes, the latter receiving a spray coating of aluminum paint.

The "Super Conservation" types, the largest of the company's can washers, are enclosed in a housing, of which the hood is of 14 gage copper-bearing steel sheets welded throughout and metallized, while the side panels are of 14 gage copper-bearing stretcher leveled galvanized steel sheets. The two finishes combined give an attractive two-toned effect.

The products as now made are far superior to those formerly made, from the standpoints of wear and rust prevention. There is no blistering nor peeling, and adhesion is perfect. Another advantage of the change, in the opinion of the company, is that all work is now done in the company's own plant (eliminating much extra handling) and under its own supervision,

The Polishing of Steel by Electrolytic Methods

PART II—Conclusion

BY DR. C. B. F. YOUNG† & WALTER L. BRYTCZUK‡

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‡ Graduate Student, Department of Chemical Engineering. Brooklyn Polytechnic Institute, Brooklyn, New York.

Apparatus

The art of polishing steel and particularly stainless steel has received considerable attention within recent years. The history of the art of electrolytic polishing is replete with disclosures of various baths and processes involving various current densities. However, except for a recent publication by H. H. Uhlig[36] entitled "The Electrolytic Polishing of Stainless Steel," it would appear that little attention has been given to a method providing a fair amount of precision for comparing the relative polishing effect of various processes by measuring the reflectivity. As a consequence thereof, it would appear that the only means of comparing the relative polishing effect of various of the prior art processes has been, and is, the visual inspection of the polished article. Such a means of determining the comparative efficiency of the various prior art processes and products involves the factor of the personal equation which, as those skilled in the art recognize, renders decisions as to the comparative results debatable. In the aforementioned article by H. H. Uhlig, the degree of polish was conveniently measured by using a photo-electric spectrophotometer designed by Prof. Hardy and described in the *Journal of the Optical Society of America*, Vol. 25, page 305, 1935. As those skilled in the art know, this is a satisfactory means of determining the degree of polish. For this work here reported, it was decided to employ a similar means of determining the degree of polish but involving measurement of the per cent reflection as compared with a glass mirror. The apparatus consists of a light source, a reflector, a filter slide, a specimen reflector and a photoelectric cell.

By determining the reflection of the standard and the reflection of the specimen, the per cent reflection for the specimen may be determined from the following formula:

$R_1 - R_2 \times 2 = \%$ loss

Where R_2 = the reading of the specimen

R_1 = the reading of the standard and

$100 - \%$ loss $= \%$ reflection

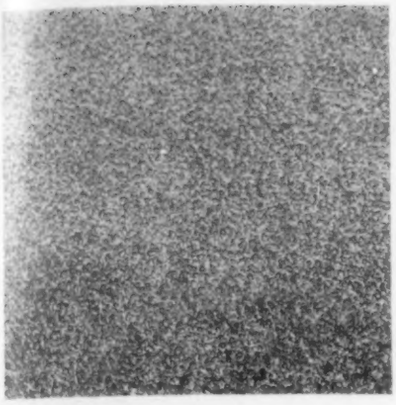
By means of this comparison of reflection, it is possible to determine the comparative polishing effect of various processes for the electrolytic polishing of metals and particularly of steels. The wiring diagram is shown in Fig. 3 and the layout is shown in Fig. 4. In operating the instrument, it is necessary to allow the multigrid vacuum tube to heat up prior to adjusting the grid bias. After heating, this adjustment is regulated to give a full scale reading. Now the milliammeter reading for the standard is obtained by inserting a glass mirror in the specimen clip. After removing the standard, the specimen to be determined is placed in the holder and the reading obtained.

The apparatus for the actual polishing tests was quite simple, consisting of a lamp bank for current supply, voltmeter and ammeter, and an electrolytic cell (beaker) in a water bath. The wiring diagram is given in Fig. 5, and a photograph of the equipment is shown on page 307. Samples of sheet steel strip were cut into pieces 1" x 2" for use as electrodes. The electrodes were roughened by rubbing with a fine emery paper (000) until zero reflectivity was obtained. Both electrodes were then immersed in the cell to the depth of 1". Under these conditions, the reading on the ammeter was equal to the current density in amperes per sq. in. since only one side of the electrode was active.

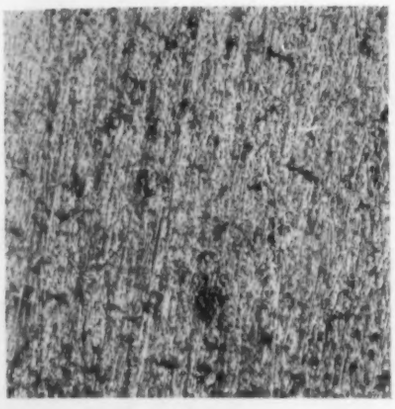
Discussion of Results

As will be noted in the data collected for the various runs, perchloric acid and acetic anhydride mixtures as used by Jacquet[15] give excellent results but are suitable only for small laboratory scale work, such as, metallographic samples. The solutions are not suitable for commercial work due to: (1) cost of ingredients, (2) hazards in use due to violent reaction upon mixing and in general with perchloric acid due to its instability and high oxidizing power, (3) necessity

Interior view of equipment for determining reflectivity



Sample polished with 000 emery 100x.



Sample etched in phosphoric and perchloric acids 100x.

Sample polished in perchloric acid and acetic anhydride 100x.

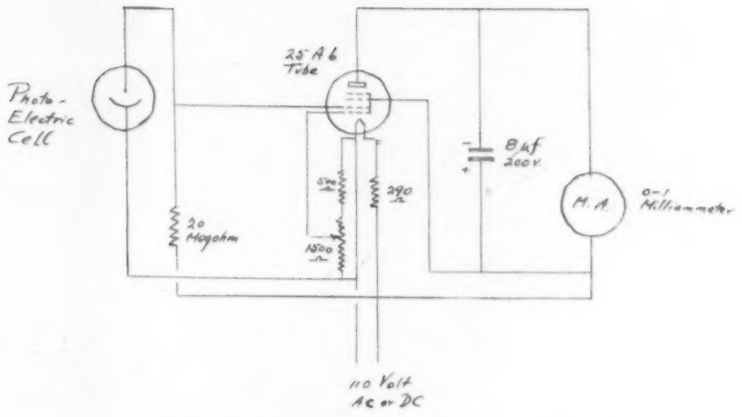


Fig. 3. Wiring diagram of reflectivity equipment.

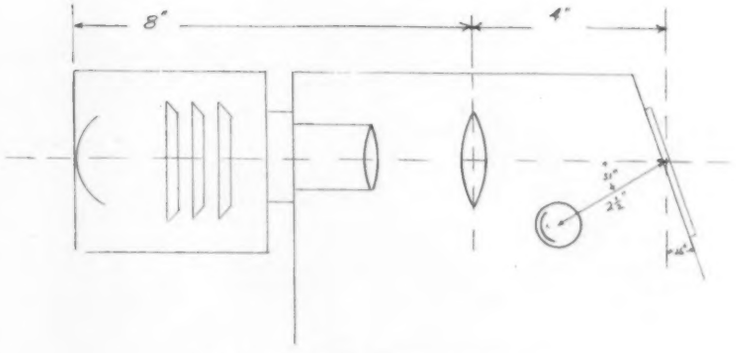


Fig. 4. Layout of reflectivity equipment.

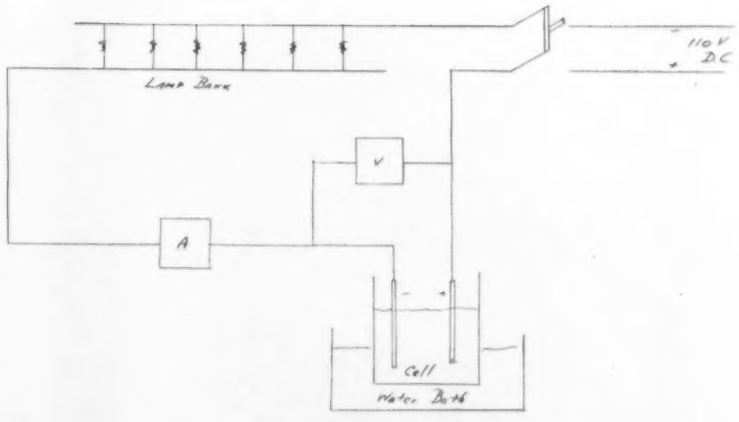
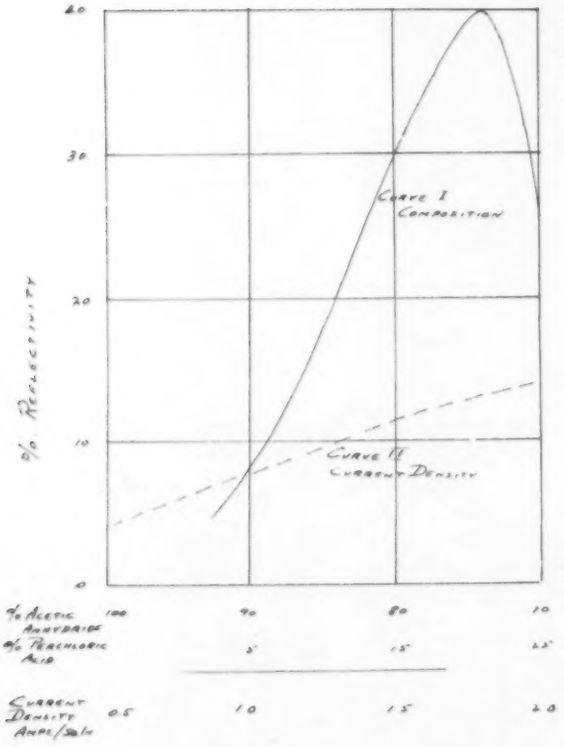


Fig. 5. Wiring diagram of polishing apparatus.

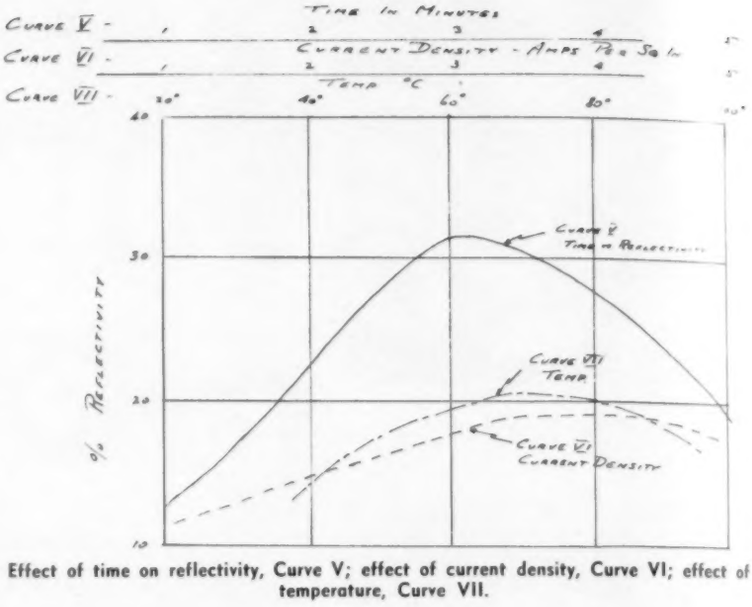
of running at very low temperature (not over 30° C.). A series was run varying the composition and the current density and results are plotted in curves I and II.

The most promising of the other combinations proved to be phosphoric and sulphuric acid. Several series were run in order to show the percentage of sulphuric acid, percentage of water, time required, temperature required, and most current density for the highest polish. The results of each are plotted in curves III to VII. In order to determine the optimum conditions, the best point was selected from the curve III, that is 80% H_3PO_4 and 20% H_2SO_4. The best composition was then used and time varied for curve V, current density varied for curve VI and temperature for curve VII. These results indicate that addition of sulphuric acid acts as a buffer preventing the chemical attack of the iron by the phosphoric acid. Considerable range is permissible with only slight variation of results.

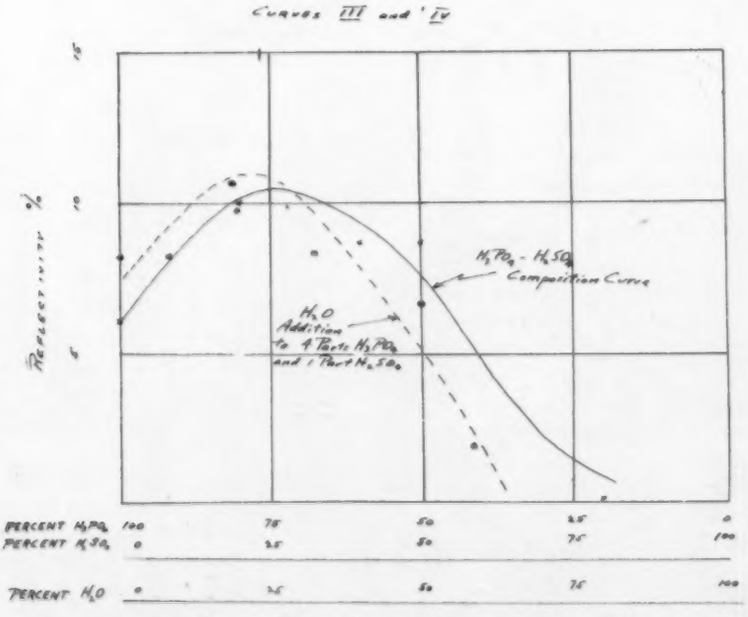
Addition of small percentages of water greatly improved the conduc-



Curve I shows change in reflectivity with composition of solution. Curve II shows effect of current density on reflectivity.



Effect of time on reflectivity, Curve V; effect of current density, Curve VI; effect of temperature, Curve VII.



Effects of varying phosphoric and sulphuric acids.

tivity and this lowered the voltage required for obtaining the desired polish. Excess water allows the sulphuric acid to attack the steel chemically causing an etch of the surface.

The time required has to be sufficient to remove all of the markings on the original surface, but exceeding this time is not desirable due to dangers of etching action starting.

As shown on curve VII, the temperature range is more satisfactory than that for most other polishing baths, good polish being obtained at temperatures as high as 70 to 80° C. Exceeding these temperatures accelerates the tendency towards etching. With the high current densities used in electroplating, the heating of the solution internally presents quite a problem where it is necessary to run a low or even room temperature.

The current density has to be sufficiently high to cause concentration polarization of the anode, that is, the formation of a thin, poorly conducting layer of liquid. As was explained in the theory, if the current density is low, the film will break down allowing corrosion of portions of the anode, thereby causing an uneven surface; whereas if the film is intact, the projecting points will be protected by a thinner layer and the hollows by a thicker layer, and therefore, the attack is greater upon the projecting points.

Conclusions

The best results were obtained using Jacquet's[15] method of perchloric acid and acetic anhydride, giving a reflectivity as high as 40%, but this method is not suitable for commercial work as explained under discussion.

The next highest reflectivity obtained was 32%, using 60% phosphoric acid, 20% sulphuric acid and 20% water. This bath gave the highest polish when run for three minutes at current density of 5 amperes per sq. in. The temperature should not exceed 80° C. It is believed that further work should be done in order to replace

(*Concluded on page* 317)

Run No.	Solution	Amp. per sq. in.	Volts	Time	Temp.	Remarks
1	75% H_3PO_4					Bright etch.
	25% H_2SO_4	3.2	4.1	3 min.		
2	"	5.0	6.0	3 "		Fair polish.
3	60% H_3PO_4					
	20% H_2SO_4	4.5	4.0	3 "		Voltage dropped to 2. Not as good as No. 2.
	20% H_2O					
4	40% H_3PO_4					
	10% H_2SO_4	5.0	2.0	4 "	53° C.	Etched.
	50% H_2O					
5	"	2.4	4.6	2 "		Etched.
6	"	6.8	5.2	2 "		Etched.
7	"	8.0	7.5	2 "		Etched.
8	50% H_2SO_4	5.5	5.8	2 "		Etched, rusts very readily.
	50% H_2O					
9	"	8.0	7.0	6 "		Streaky, etched.
10	96% H_2SO_4	Very low	18.0	1 "		No action.
11	75% "	8.0	10.5	3 "		Voltage rose to 12.8. Scum or slime forms on anode.
	25% H_2O					Washed off but reformed.
12	"	1.6	18.0	2 "		Slime continues to form.
13	83% H_2SO_4					Fluctuation of current from 1.1 to 4.0 amps. dipping
	17% H_2O	2.2	18.0	2½"		first then rising.
14	"	0.6	18.0	4 "		Current fluctuates.
15	90% H_2SO_4	4	39	2 "		Slime formation.
	10% H_2O					
16	90% H_2SO_4	10	100	15 sec.		Slime formation etch under slime.
	10% H_2O					
	(HCHO)					
17	1% Formaldehyde					
	to No. 15	10	100	10 "		Obnoxious fumes.
18	"	7½	40	45 "		Obnoxious fumes.
19	85% H_3PO_4	5	18	4 min.		Voltage dipping to 12. Fair polish.
	15% H_2O					
20	70% H_3PO_4					
	30% H_2O	5.2	8	3 "		Not as good as No. 19.
21	"	8	12	3 "		Not as good as No. 19.
22	"	5.2	14			Clean, light colored matte surface.
23	"	5.35	7			Clean, light colored matte surface.
24	60% H_3PO_4	5.2	5.5			Matte surface.
	40% H_2O					
25	"	0.4	1.0			Matte surface.
26	"	10.2	10.0			Matte surface.
27	50% Chromic acid	0.3	2.6			No change.
28	"	6.0	6.0			Jet black, smooth coating formed. Surface appears polished.
29	"	6.0	5.4			Same as No. 28.
30	76½% Acetic anhydride					Violent reaction upon mixing, could not add acetic
	18½% Perchloric acid					anhydride to perchloric acid. Added acid slowly
	5% H_2O					to acetic anhydride. Put in piece of aluminum and
	½% Al	0.3	12-24		16° C.	allowed to stand for one week. Highest polish
31	76½% Acetic anhydride					obtained. Voltage rises. Increasing more with
	18½% Perchloric acid					agitation.
	5% H_2O					
	½% Al	0.45	22-34		26° C.	Good.
32	"	0.8	28-30	5 min.	17° C.	Good.
					32° C.	
33	Same as No. 28	0.4	4.0	2 "		Much lower voltage required after standing for several weeks. Only fair polish.
34	" " " "	0.8	6.0	2 "		Good polish.
35	" " " "	1.6	12.0			Good polish, but low reflectivity (6%).
36	" " " "	5.0	20.0	½ "	55° C.	Slight tendency to etch with the higher temperature. Fair reflectivity 80%.
37	94% Acetic anhydride					
	6% Water	0	120		19° C.	No current flow.
38	88% Acetic anhydride					
	6% Water					Rapid rise in temperature. No polish.
	6% Perchloric acid	1.3	100	1½ "	80° C.	
39	83½% Acetic anhydride					
	11% Perchloric acid	2.2	80		32° C.	Voltage decreases with temperature rise.
	5½% Water	2.8	68	1½ "	70° C.	
40	79½% Acetic anhydride					
	15½% $HClO_4$					8% reflectivity. Cell stopped when temperature
	5% H_2O	2.4	82		23° C.	rose to 43° C.
		2.8	64	40 sec.	43° C.	

Run No.	Solution	Amp. per sq. in.	Volts	Time	Temp.	Remarks
41	75½% Acetic anhydride $(CH_3CO)_2O$					7% reflectivity. Stopped when temp. rose due to acetic fumes given off.
	19½% $HClO_4$	3.6	56		37° C.	
	5% H_2O		48		48° C.	
42	72% $(CH_3CO)_2O$					
	4½% H_2O					Very little temp. rise at this current density. Fair
	23½% $HClO_4$	0.4	9-11	2 min.	34-35	reflectivity. 7%.
43	78% $(CH_3CO)_2O$					
	3½% H_2O					10% reflectivity. This same electrolytic composition
	18½% $HClO_4$	0.4	10-12	2 "	33-35	with aluminum previously gave a much higher polish. (Temp. was lower).
44	87½% $(CH_3CO)_2O$					
	2% H_2O					Spotty. Black scum forms showing an etch under
	10% $HClO_4$	0.4	14-18	4 "	33	the scum upon washing. 8% reflectivity.
45	78% $(CH_3CO)_2O$					
	3½% H_2O					
	18½% $HClO_4$	0.4	12-24		23° C.	
46	90% H_3PO_4					
	10% Perchloric acid	4.8	28		18° C.	
47	80% H_3PO_4					
	20% $HClO_4$	5.0	20			Satin finish.
48	"	0.9	2-18			Very good. Satin finish.
49	"	0.6	3-12			Satin finish.
50	"	5.1	20-30			Brown slime, satin finish under slime.
51	"	1.6	10			Light scum formed. Satin finish beneath scum.
52	67% H_3PO_4					
	33% $HClO_4$	0.9	6-10			
53	67% H_3PO_4					
	33% $HClO_4$	5.0	14-20			
54	45% Chromic acid					
	13% $HClO_4$					No action.
	42% H_2O	0.82	3.0			No good. Heavy black slime formed.
55	Same as No. 52	5.6	10.0			No good. Heavy black slime formed.
56	26% Chromic acid					
	7½% Perchloric acid					
	66½% H_2O	6.0	7.0			
57	86% Phosphoric acid	5.0	15.0	2 min.		5% reflectivity, fair polish.
58	Same as No. 57	5.0	15.0	sec.		Current on until gassing starts at anode. 2% reflectivity.
59	86% H_3PO_4					
	5% Chromic acid	0.2	2-4	2 min.		1½% reflectivity. Clean but not polished.
60	Same as No. 59	0.8	7-6	2 "		2% reflectivity. Not polished.
61	" " " "	5.8	20-12	3 "		5% reflectivity. Good but no better than straight phosphoric.
62	78% H_3PO_4					
	17½% H_2O					
	4½% Chromic acid	5.2	12			Etched, action continues after current is off.
63	Same as No. 62	No current				Sample etched.
64	72% H_3PO_4					
	4% Chromic acid					
	24% H_2O	5.3	9	2 "		Etched, slightly discolored.
65	Same as No. 64	5.2	8	4 "		No improvement over Run No. 64 with increased time.
66	" " " "	0.9	2	3 "		Etched.
67	82% H_2SO_4					
	5% Citric acid					
	13% H_2O	0.8	34	2 "	78° C.	Slight discolor.
68	Same as No. 67	0.2	34			Max. voltage slowly reached then gradually decreasing.
			24	3 "		
69	" " " "	0.8	34			
70	77% H_2SO_4					
	5% Citric acid					Better polish than Run No. 67 but only 1% reflectivity.
	18% H_2O	0.8	30			
71	Same as No. 70	4.0	36			Not as good as No. 70. Voltage fluctuating, decreasing to 20 then back up to 34.
72	82% H_2SO_4					Took 15 sec. for voltage to rise from 2 to 40 volts.
	15% $HClO_4$	0.2	40	1 "		Very slight action.
72-A	Same as No. 72	0.2	40	2 "		Sample darkened.
73	" " " "	0.5	40	1 "		No action, sample discolored.
74	71% H_2SO_4					
	14½% $HClO_4$	0.8	20			Voltage rose to 32, then staying at that point. Slight
	14½% H_2O		32	2 "		action, slight discolor of sample.
75	Same as No. 74	1.4	32			Slight action. Corners discolored.

Run No.	Solution	Amp. per sq. in.	Volts	Time	Temp.	Remarks
76	" " " "	4.2	32			Discolored, not polished except along the edges.
77	63% H_2SO_4 11½% $HClO_4$ 25½% H_2O	0.8	5	2 "		Some actions, slight discolor. Much lower voltage than No. 74.
78	Same as No. 77	1.6	7	2 "		Discolored.
79	" " " "	5.3	12	3 "		Discolored.
80	63% H_2SO_4 6% $HClO_4$ 29% H_2O 2% Citric acid	5.2	15	2½ "	57° C.	Discolored.
81	69½% H_2SO_4 4% $HClO_4$ 25% H_2O 1½% Citric acid	4.2	39	1 "		Discolored.
81-A	Same as No. 81	1.3	36-20		60° C.	Discolored.
82	67½% H_2SO_4 4% $HClO_4$ 27% H_2O 1½% Citric acid	1.4	16			Discolored.
83	65½% H_2SO_4 4% $HClO_4$ 29% H_2O 1½% Citric acid	1.4	18-24	3 "		Slight polish 1% reflectivity.
84	64% H_2SO_4 4% $HClO_4$ 30½% H_2O 1½% Citric acid	1.4	24-12			
85	95% $HClO_4$ 5% H_2O Tr. Chromic	0.7	4	2 "		Chromic acid only very slightly soluble, slight coloration of solution. Light yellow colored slime formed on anode causing etch. Portion uncoated with slimes appear polished. Only slight gassing at anodes. Vigorous gassing at cathodes.
86	Same as No. 85	1.5	4	1½ "	27° C.	More of the surface covered with slime.
87	" " " "	0.4	4			Slime formed, slight etch.
88	" " " "	6.0	7		29° C.	Slime formed, heavy etch, but portions uncoated had good polish, 4% reflectivity. Solution lost yellow color.
89	86% $HClO_4$ 14% H_2O Tr. Chromic	0.8	4			Slime formed, sample etched.
90	85% $HClO_4$ 4% Oxalic	0.8	2			Black slime formed, easily washed, fine etch but discolored.
91	90% H_3PO_4 10% H_2O 0.01 g./l. gelatin	5.0	20 10	4 "		Satin finish, bright, 8% reflectivity but scratches show. Action continues after power is off. Gassing at anode is much finer than without gelatin.
92	14% H_3PO_4 74% H_2SO_4 12% H_2O 0.02 g./l. gelatin	4.8	20-15	3 "		Action continues after power is off.
93	Same as No. 92	4.8	12	3 "		Sample removed as soon as current is off.
94	13% H_3PO_4 71% H_2SO_4 16% H_2O 0.03 g./l. gelatin	5.0	12			Sample washed immediately upon removal from bath. Solution became milky. Sample etched showing slight polish on corners.
95	50% H_3PO_4 40% H_2SO_4 10% H_2O 0.04 g./l. gelatin	5.0	7	2 "		Additional phosphoric acid added to solution No. 94. Solution cleared, gave very good results. Reflectivity of 14%.
96	Same as No. 95	1.5	4		60° C.	Good polish but coarser grained than Run No. 95.
97	" " " "	6.0	8	2 "	57° C.	Good polish, 4% reflectivity.
98	" " " "	5.2	8			Good polish, 8% reflectivity.
99	" " " "	6.0	12		33° C.	Fair polish. Reflectivity only 3%. Not as good as higher temperature.
100	40% H_3PO_4 40% H_2SO_4 20% H_2O	5.3	8	2 "	90° C.	Bright surface, slight etch. 10% reflectivity.
101	37½% H_3PO_4 37½% H_2SO_4 25% H_2O 0.01 g./l. gelatin	5.4	7	2 "	88° C.	Bright surface, but etched. 2% reflectivity.
102	45½% H_3PO_4 45½% H_2SO_4					Slight slime. Showing bright surface after washing slime off. 6% reflectivity.

Run No.	Solution	Amp. per sq. in.	Volts	Time	Temp.	Remarks
	9% H_2O	5.2	10	2 "	84° C.	
103	40% H_2SO_4 56% H_3PO_4 4% H_2O					
	0.01 g./l. gelatin	5.2	10	2 "	83° C.	4% reflectivity.
104	Same as No. 103	6.2	10	2 "	86° C.	10% reflectivity.
105	" " " "	6.1	14	1 "	69° C.	2% reflectivity.
106	" " " "	5.2	16	2 "	38° C.	4% reflectivity.
107	100% H_3PO_4	5.2	15	2 "	33° C.	Sample still showed scratches.
108	Same as No. 107	5.2	12	4 "	58° C.	6% reflectivity.
109	80% H_3PO_4 20% H_2SO_4	5.2	10	3 "	33° C.	10% reflectivity.
110	60% H_3PO_4 40% H_2SO_4	5.2	10		43° C.	8% reflectivity.
111	50% H_3PO_4 50% H_2SO_4	5.2	9		44° C.	8% reflectivity.
112	40% H_3PO_4 60% H_2SO_4	5.2	11		39° C.	4% reflectivity.
113	17% H_3PO_4 83% H_2SO_4	5.0	16		41° C.	Sample discolored. Solution becoming cloudy.
114	96% H_2SO_4	4.2	35		36-64° C.	Solution became milky. Sample discolored.
115	80% H_3PO_4 20% H_2SO_4 (Same as No. 109)	5.4	17-12	2 "	60° C.	8% reflectivity.
116	10% H_2O added to No. 115	5.4	18-13	2 "	38° C.	8% reflectivity.
117	20% H_2O added to No. 115	5.4	12-10	2 "	41° C.	10% reflectivity.
118	30% H_2O added to No. 115	5.5	10-8		43° C.	6% reflectivity.
119	40% H_2O added to No. 115	5.5	8-7		42-51° C.	10% reflectivity.
120	50% H_2O added to No. 115	5.4	7		44-50° C.	7% reflectivity.
121	60% H_2O added to No. 115	5.4	7		45-51° C.	2% reflectivity.
122	Same as No. 117					4% reflectivity.
	67% H_3PO_4 16½% H_2SO_4 16½% H_2O	5.3	12	½ "	33° C.	Shows scratches.
123	Same as No. 122	5.3	12	1 "	33° C.	6% reflectivity.
124	" " " "	5.3	12	2 "	33° C.	5% reflectivity.
125	" " " "	5.3	12	3 "	33° C.	32% reflectivity.
126	" " " "	5.3	12	4 "	33° C.	8% reflectivity.
127	" " " "	5.3	12	5 "	33° C.	8% reflectivity.
128	20% HCl 80% H_2O	5.5	5.5	2 "	32° C.	Dark etch.
129	18% HCl 90% H_2SO_4 73% H_2O	5.6	3.0		53° C.	Dark etch.
130	17% HCl 17% H_2SO_4 66% H_2O	5.6	3.0		69° C.	Dark etch.
131	67% C_2H_5OH 33% HNO_3	5.6	12.0			Sample discolored dark brown.
132	67% CH_3OH 33% HNO_3	5.6	3.0			Coarse grained etch.
133	40% H_3PO_4 60% Glycerin	1.0	8.0		52° C.	Coarse and etched, not polished.
134	Same as No. 133	2.4	24-14		44-84° C.	Coarse and etched, not polished.

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

SHOP PROBLEMS

Because of the interest in shop problems, we are publishing herewith many more problems than ordinarily published. Unless otherwise noted, the answers are those of the editor, Dr. Walter R. Meyer. If any reader can answer any questions unanswered, or can suggest better answers, they will be gratefully received.

English Process

Winnipeg, Can.

"Gentlemen:

We have been asked to do 'Roval' plating, which we understand is an English process termed 'Roval 85' process. We will be grateful if you will give us any information regarding this process."

W. B.

We are not familiar with this process and if any of the readers of METAL FINISHING are acquainted with the details regarding the same, will you kindly write to the editor, explaining the process. This help will be greatly appreciated, inasmuch as the process has been specified on war goods for Canadian use.

Cadmium Plating

Greensboro, N. C.

"Gentlemen:

We would like to know the plating time and current necessary to cadmium plate small steel articles up to Government standards. For instance, how long would be the plating time required at the regular voltage and amperage generally used on cadmium? What is the best voltage and amperage to use on small steel parts such as bomb firing pins? In other words, we are not familiar with cadmium plating but we are with several other plates, and we would like full information to meet Government requirements."

R. C. H.

Dear Sir:

There is no general Government standard on cadmium plating and the thicknesses required can be determined by referring to the original order. The usual thicknesses of cadmium applied are 0.0002" and 0.0005".

The subject of cadmium plating is discussed thoroughly in the 1942 "Plating and Finishing Guidebook," which was published on May 18. The cathode efficiency of cadmium plating solutions usually does not vary greatly with current density and thus there is no "best" current density. Usually the highest current density is used that will not give burning, and values as high as 20 amp./ft.^{2} are being used in still tanks, and higher values may be used when the cathode is agitated.

In still plating, approximately 0.0003" of cadmium is deposited in 10 minutes at 20 amp./ft.,^{2} but in barrel plating about 30 minutes will be required to deposit the same thickness if 12 volts are used.

Plating Plastics

Chicago, Ill.

"Gentlemen:

We are very much interested in a process of plating plastics and wood without using copper and the type of machinery needed for such work.

We would appreciate it very much if you let us know by return mail the method best suited for our line of novelty jewelry."

V. B. & O. Co.

Dear Sir:

The recent re-issue of the M-9-c order of the War Production Board bans the use of copper for electroplating unless the job has an A-1-k or higher rating.

The only metals left for plating plastics, therefore, are gold, platinum and silver. A proprietary process has been developed for silver plating upon plastics and this process is marketed by the Metaplast Corp., 205 W. 19th St., New York, N. Y.

False Rumor on Closing Shop Plating Shops

Miami, Fla.

"Gentlemen:

There are reports being circulated here to the effect that the Government is closing all job plating shops. If you have any information covering this, would you kindly advise."

H. L. S.

Dear Sir:

In reference to your letter of April 9th, we have heard no mention made by any WPB men or other people regarding the rumored plan to close job plating shops.

Naturally, the many restricting orders made on plating have resulted in closing some shops and have sharply curtailed production. We seriously doubt whether any closing order will ever be published. The essential orders pertaining to the plating industry were reviewed in the April issue of METAL FINISHING.

If you have not received this issue, let us know and we will send you a copy.

To obtain information on plating orders issued by WPB, we suggest writing to G. B. Hogaboom, Principal Consultant on Plating & Finishing of the Conservation and Substitution Branch of the Bureau of Industrial Conservation, WPB, Washington, D. C.

Pickling Brass

Bumley, Lansc., Eng.

"Gentlemen:

We started off with a 5% sulphuric acid solution but after a few days the solution becomes contaminated with copper and we get a pink finish. Can you suggest any methods of eliminating this copper color without resorting to any other dip outside of our present cycle, which is: Acid pickle, cold water rinse, hot water rinse."

S. J. J.

Dear Sir:

A uniform pickling of copper can be accomplished by the use of ferric sulphate solutions. The ferric sulphate solution will dissolve both the copper and the zinc, thus resulting in the characteristic yellow finish being obtained rather than a coppery type finish. Ferric sulphate can be purchased from Merrimac Div., Monsanto Chemical Co., Everett Sta., Boston, Mass., as "Ferrisul". The use of Ferrisul in pickling of copper alloys as well as other metals is discussed at length in the 1942 "Plating and Finishing Guidebook".

Free Zinc on Sherardized Coatings

Bridgeport, Conn.

"Gentlemen:

We would like some authoritative information on the detailed structure of a sherardized coating on steel and will appreciate it very much if you can give us a brief answer to the following questions.

Standard texts on the subject of metal finishing and corrosion resistance do not give specific answers to the questions we have in mind.

1. We are aware that the outer portion of a sherardized coating is very rough and that a certain amount of 'zinc dust' will probably be entrained in the minute fissures in the surface of the coating. This 'zinc dust' is apparently not all pure metallic zinc, but may consist of a substantial percentage of zinc oxide, zinc-iron alloy and some impurities. Can you estimate the percentage of the coating which consists of pure zinc particles or could you give the amount of pure zinc present in a sherardized coating in terms of ounces per square foot of surface area?
2. Enclosed is a small blue print showing a cross-section of the threaded end of a piece of rigid conduit on which an organic coating has been applied over a sherardized coating. This blueprint shows the sherardized coating

to consist of two layers, an inner layer of zinc-steel alloys and a second outer layer of pure zinc. Is there sufficient pure zinc in the porous outer portion of a sherardized coating to make this sketch an accurate representation of the cross-section of a sherardized rigid conduit?

It will be greatly appreciated if you can give me a brief answer to each of these questions."

G. E. Co..

Dear Sir:

I would like to state first of all that the drawing is a poor representation of a sherardized coating, and in addition the marking is very confusing.

Probably the best discussion of sherardized coatings is given in Burns and Schuh's new book, "Protective Coatings for Metals".

The amount of free zinc on a diffusion type coating, such as sherardizing, would certainly be less than 1% of the total zinc of the coating, and the loosely adherent zinc dust could hardly be classified as being part of the coating. Therefore, there is practically no free zinc zone in a sherardized coating.

Two alloy layers have been identified, and I doubt whether the composition of these layers is uniform. The first layer, namely that one adjacent to the iron, can probably be represented by the formula $FeZn_{10}$, with an iron content ranging from 8 to 10%, and the second layer in the sherardized coating, namely, the outer layer, can probably be represented by the formula $FeZn_7$. If you will look in the book mentioned, you will notice some excellent cross-sectional photomicrographs that illustrate the structure just described.

Rough Nickel

Fort Smith, Ark.

"Gentlemen:

We are sending under separate cover today several samples from two of our plating tanks, and would appreciate your analyzing these so that we can determine how to overcome the difficulty that we have with these two solutions.

We wish to advise that due to the nickel condition† we are using 18 carbon anodes and only 13 nickel anodes. The deposit on the shears is very rough and black, and is very hard to buff. If you have any suggestions, they would be appreciated."

S. S. S. Co.

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† This letter was written before Apr. 1, when WPB Order M-6-b went into effect.—Ed.

Dear Sir:

Analyses were as follows:

	#2	#3	
Metallic nickel	2.2	1.5	oz./gal.
Chloride as ammonium chloride	1.6	1.2	"
Boric acid	4.3	1.7	"
pH	5.9	5.6	

The metal and chloride contents of these solutions should be 3 oz./gal. and the boric acid content about 4 oz./gal.

The #2 tank shows crystallization of double nickel salts and would indicate that the solution is saturated. To bring the metal contents up to 3 oz./gal. only single nickel salts should be added.

The rough deposit on the work is probably due to disintegration of the carbon anodes liberating particles which become attached to the work. We would suggest that the carbon anodes be examined to see whether they are roughened. If so they should be bagged with muslin bags or preferably duplex bags of muslin and filter paper.

It is not advisable to use carbon and nickel anodes together because chlorides are required for the corrosion of the nickel anodes and this results in the liberation of chlorine gas at the carbon anodes. If you intend to operate with carbon anodes only, the ammonium chloride additions suggested above should be omitted.

—G. B. H.

Peeling Nickel on Brass and Solder

Shelton, Conn.

"Gentlemen:

We are sending you by parcel post samples of our plating. Kindly advise us how much copper plate and nickel plate are needed on these pieces to stand a 200-hour salt spray test; also the thickness. The base metal is all brass with soldering joints.

At the present time we are putting on 0.0003" copper, that is cyanide copper, 15 amp./ft.² minutes time, nickel 5 amp./ft.² 40 minutes time 0.00015-0002". Our copper is made up of 3.5 oz. copper cyanide, 5 oz. sodium cyanide, 4 oz. sodium carbonate, and 1/16 oz. sodium thiosulphate as a brightener. Our nickel at the present time is a regular white cold dull solution. We are changing to a warm Watts solution. Our cleaning cycle is as follows:—

Reverse cleaner 20 seconds, cold rinse, bright dip 2 parts sulfuric - 1 part nitric, cold rinse, reverse cyanide 6 oz. 20 seconds, cold rinse. Copper plate 30 minutes, nickel plate 30 minutes, silver plate 15 minutes. We are using a sulfuric nitric bright dip instead of muriatic acid because the muriatic does not cut the burnt flux that is on the base metal.

Kindly let us know what causes the copper to be brick red, and, at times, etched. Also what causes the nickel to rub off on the edges only.

Words cannot express our appreciation of this favor."

M. S. Co.

Dear Sir:

The writer has read your letter of April 8th, and has examined the parts sent rather carefully.

I assume that your nickel solution is satisfactory and we have to look for other sources of trouble. However, I would like to point out that a cold nickel solution usually gives brittle deposits when operated at current densities above 15 amperes per sq. ft., and it is possible that you may be getting localized higher current densities at the edges of the work. If this is the case, the use of a Watts type of solution will overcome this trouble.

If you are putting in a Watts solution, I suggest you get one of the agitators to cause the cathode bar to reciprocate. The movement of the cathode bar will enable you to use current densities up to 35 amperes per sq. ft., providing the temperature is from 120 to 130° F.

In regard to your cleaning cycle, I would suggest discontinuing one operation and that is the electrolytic cyanide treatment that you are now using. Electrolytic cyanide treatment may make the work polarize, especially by the high current density spots near edges of the sheets, and the insoluble films thus formed may not redissolve readily, and these may contribute to peeling. I would suggest using a simple immersion dip in a cyanide solution, composed of 3 oz. per gal. of sodium cyanide and 2 oz. per gal. of caustic soda, the mixture being heated to 120° F.

Another possible source of trouble is that lead may dissolve in the solution from the solder and be replated out as lead dioxide on the high current density portions of the work. Lead will plate out on both the cathode and anode in an alkaline solution, such as sodium cyanide solution.

In regard to obtaining 200 hours' resistance in salt spray, I believe that you will have to plate a minimum of 0.001" of total plate. Salt spray data of the Bureau of Standards indicate that even with 0.001", nickel, some corrosion is obtained on steel after 100 hours of salt spray.

Breaking of Springs After Plating

Portland, Maine.

"Gentlemen:

We have been cadmium plating some flat steel springs, 1" long, about 22-gauge, and our customer complains that the springs break.

We would greatly appreciate it if you could advise us whether or not this breakage could be caused by plating or if it is caused by the hardening. We have never dipped the springs in any solution warmer than you could put your hand into."

O. P. P. Co.

Dear Sir:

We believe the embrittlement of the springs mentioned is entirely due to cadmium plating.

We are enclosing a copy of an article that appeared in *Metal Finishing* on "Hydrogen Embrittlement", and also a shop problem.

To overcome your difficulty, you should give the springs a heat treatment for at least one hour at 350° F. To check whether any residual embrittlement remains, we suggest bending a spring and observing whether the plated spring can be bent or closed to the same extent as an unplated spring. If we have not given all the details that you require, please write again.

What is "Nitrating"

Philadelphia, Pa.

"Gentlemen:

Can you supply me with information on

the process called 'nitrating', just what it is, and how it is done.

You may be sure that I will appreciate any data you may be able to furnish me."

O. M. S.

Dear Sir:

We have never heard of the term "nitrating". However, there are some processes that sound something like nitrating. One of these processes is nitriding, which involves subjecting steel articles to an ammonia atmosphere to produce nitrides. This process is a form of surface hardening.

Mixtures of sodium and potassium nitrates have been used to produce blue-black colors on steel. Usually a 50-50 mixture of salts is used, and the operating temperature varies from 700 to 800° F. This bath is also used for producing red cuprous oxide films on copper, and conceivably the process could be called "nitrating". Some of the chemical blackening processes use nitrates together with caustic soda.

If you can give me a little more information on the finish desired, we may be able to give you specific information.

Does anyone know a process called "nitrating"?

Brush Plating

Dayton, Ohio.

"Gentlemen:

We are interested in doing some brush plating at our plant and would appreciate your forwarding to us full information on these types of brushes."

U. A. P., Inc.

Dear Sir:

Apparatus for brush plating is made by Portable Pltg. & Equip. Co., 1000 S. Michigan Ave., Chicago, Ill., and Rapid Electroplating Process, Inc., 1414 S. Wabash Ave., Chicago, Ill.

These companies will be pleased to send you literature describing their products and giving specific directions for operating the equipment.

Simple brushes can be made by taking a ¾" round bristle brush and inserting a piece of metal, which is to be plated. This metal is then connected to the positive terminal of the electrical source and the brush is dipped in the plating solution. Usually, the plating solution is thickened with material, such as agar agar or methyl cellulose to make a molasses-like consistency to prevent the solution from running off the brush over the work.

Disposal of Waste Water

Boonton, N. J.

"Gentlemen:

Some weeks ago I read an article on treatment and disposal of waste waters from the plating room. It was a description of a process used by a Long Island company in which the pH was adjusted, and chromium and other constituents precipitated.

Can you tell me if this article has been published in METAL FINISHING and, if so, advise the issue in which it appears? I have searched my remaining copies in vain, but feel sure it appeared within the last year and a half.

Thanking you for your trouble in this matter."

A. R. Corp.

Dear Sir:

The article to which you refer was written by Milton Hodges, Engineer of Electrolux Corp., Old Greenwich, Conn.

The article was entitled, "Treatment of Plating Room Waste Water", and was published on pages 70-71 of the February 1941 issue of METAL FINISHING.

Plating Restrictions

Portland, Maine.

"Gentlemen:

We do chromium, nickel, copper, brass, and silver plating and understand that there has been an order go through as of April 1 pertaining to plating.

We would greatly appreciate it if you would advise us whether or not it is necessary for us to get priorities on job plating in the future.

Any information that you can pass along would be greatly appreciated."

O. P. P. Co.

Dear Sir:

We have attempted throughout the past few months to summarize the status of restriction orders on plating, in issues of METAL FINISHING, and we particularly recommend the April issue.

There are definite restrictions on the use of chromium, nickel, copper, brass, tin and zinc plating, and the essential features of these restrictions are outlined in the April issue. The only metals available for plating without restriction are silver, platinum and gold.

If you wish more information regarding the various orders, we suggest securing a copy from WPB of the various orders mentioned in the April issue.

Plating Upon Lead Solder

North Attleboro, Mass.

"Gentlemen:

We are sending you an object that has been soldered with lead type solder and we would like you to recommend a procedure to enable us to cover the lead solder."

E. C. Company.

Dear Sir:

Soldered objects are usually treated as follows for plating:

1. Pre-clean in solvent or solvent-vapor degreaser, or by using an immersion type cleaner. This permits a much shorter cleaning time in the alkaline cleaner and thus reduces attack upon the solder by the alkali.

2. Alkaline clean using a non-soap or resin type of cleaner. Cleaners containing certain wetting agents that do not form insoluble lead soaps are satisfactory. The cleaning should be done either without current or if current is used, the work should be made the cathode.

3. Frequently the work is given a short reverse current clean for about 5 seconds in a separate cleaner. This operation may be omitted.

4. Immerse in cold hydrochloric acid, 1 volume of acid to 2 volumes of water.

5. Rinse in running cold water.

6. Dip in a solution composed of 2 oz. per gallon caustic soda and 3 oz. per gallon of sodium cyanide.

7. Plate in cyanide type copper plating solution.

8. If the object is to be subsequently nickel and chromium plated, a ductile type of nickel is usually more satisfactory than a hard nickel, and the chromium plating time should not exceed 1½ minutes, and racking should be done so that no burning of the chromium occurs. The buffing of the nickel should also be done lightly without using heavy pressure. Heavy buffing of the nickel as well as buffing of the chromium may cause the plate to blister regardless of the preparation of the work previous to plating.

Plating Surgical Instruments

Miami, Fla.

"Gentlemen:

Will you be kind enough to help us in the following problem. We are getting ready here for plating surgical instruments (not stainless steel) and would like to know the order of procedure.

Should the instrument be copper plated? When should it be sharpened and honed, before, after or during the different plating? Your giving us the method of doing properly this kind of work will be appreciated very much.

Would you also give us the necessary pH and metal content of the nickel solution? What would be the reason for brittleness and peeling?

Thanking you in advance for your prompt attention to our request."

L. T. Mfg. Co.

Dear Sir:

The sharpening of surgical instruments is done after plating.

The best method of plating them would be to apply the nickel directly to the steel and if proper cleaning of the base steel is done, there is no need of applying an undercoat of copper.

The alloy that you are using is high in carbon and thus care should be taken that it is not pickled too long, as otherwise a heavy smut may form on the work.

Anodic type of alkaline cleaning is recommended using strong alkaline cleaning materials designed for anodic use. This type of cleaner tends to make the steel bright and clean, and thus obviates any peeling difficulties from carbon smut. After cleaning, the work should be thoroughly rinsed and dipped for about 10 seconds in a solution of muriatic acid, made by diluting 1 gallon of acid with two gallons of water.

The nickel solution to be used can be either the Watts type of solution described in our Guidebook, or if operated cold, the single nickel salt, also described in the Guidebook.

The pH of the cold solution should be maintained between 5.2 and 5.8, and the

current density should not be above 12 amperes per sq. ft. Higher pH values cause the plate to be brittle, and higher current densities do likewise.

The presence of small amounts of copper or zinc in the plating bath may also cause embrittlement, and these impurities can be removed by electrolyzing the bath at low voltages of the order of 1 to 1½ volts.

I would like to emphasize again that proper cleaning of high carbon steel is very essential in obtaining good adhesion especially when the article is to be subsequently ground.

Zinc Plating Malleable Iron

Fitchburg, Mass.

"Gentlemen:

We have been barrel zinc plating steel successfully in a solution made with formula for Bright Zinc as given in 1941 Guidebook, but are now called upon to plate malleable and gray iron castings in the same bath and have had little or no success.

Is there at the present time an approved preliminary treatment or a patented zinc bath by which these materials can be successfully barrel plated?"

I. L. Co.

Dear Sir:

The difficulty described in your letter is one generally met in industry.

The reason why it is not possible to zinc plate cast and malleable iron is that the hydrogen overvoltage on carbon is considerably lower than the deposition potential of zinc and, therefore, hydrogen is deposited instead of metal.

The only satisfactory way of plating the gray iron castings would be to apply some other metal that deposits at a lower potential, such as copper or cadmium. Usually cadmium is used when only a light coating is required. Several people have reported that the use of 1 oz./gal. of cadmium in the zinc solution would overcome this difficulty, but obviously the use of cadmium in the zinc solution would alter its bright plating characteristics, and you would get a zinc-cadmium alloy rather than a pure zinc deposit.

Thanks Expressed

Portland, Maine.

"Gentlemen:

We wish to thank you for your letter of April 10 regarding the cadmium plating of springs. We have passed this information on to our customer and feel sure that your letter will help us overcome our difficulty.

Should there be a charge for this, please mail us your bill and we will forward our check by return mail.

Thanking you again."

O. P. P. Co.

Dear Sir:

We appreciate your letter of April 17th, and wish to state that there is no charge for our technical advice.

We are pleased to serve subscribers of METAL FINISHING, and other people interested in finishing processes.

Silvering Glass

Brooklyn, N. Y.

"Gentlemen:

Please be kind enough to send us all data on the preparation of glass for silver plating.

We would like to know formula for this type of work and all articles needed for this process."

M. M. Mfg. Co.

Dear Sir:

In reference to your letter of April 14th, complete details on the silvering of glass are given in Bureau of Standards Circular No. 389, entitled, "Making of Mirrors by the Deposition of Metal on Glass", by I. C. Gardner and F. A. Case.

This circular can be secured by sending 5c, in coin, to the Bureau of Standards, Washington, D. C.

Electropolishing Sterling Silver

New York, N. Y.

"Gentlemen:

In your publication, 'Plating and Finishing Guidebook' for 1941 you have an article by Harold M. Lang about 'Electrolytic Polishing of Metals.'

We are very much interested to apply this process on sterling silver jewelry with undercuts and crevices, where polishing is next to impossible.

Kindly let us know where we can obtain the solutions for the above mentioned process and greatly oblige."

V. J. N. Co.

Dear Sir:

A method of electrolytically polishing silver has been proposed in a recent paper by L. I. Gilbertson and O. M. Fortner, which was published as preprint 81-5 of the Electrochemical Society, Columbia University, New York.

We believe that you can secure a copy of this paper by sending 50c in coin to the Electrochemical Society.

Deep Etching on Iron

Bay City, Mich.

"Gentlemen:

We have a problem in our shop which we would like to have you solve for us.

We would like to know of a bright dip for iron and steel which could be used for producing a finish similar to that of new files. We saw a formula for this but cannot at present put our hands on it."

G. Mfg. Co.

Dear Sir:

A rough etched finish on iron and steel can be produced with solutions of ferric chloride or ferric sulphate, or dilute nitric acid, using 1 volume of acid to 2 volumes of water. The ferric salts may be used warm, say 150° F., and at concentrations ranging from 10 to 30% by weight.

In deep etching of this kind, a considerable quantity of carbon smut will be formed which must be removed by scrubbing. It can also be removed by using reverse current in a strong caustic soda solution, using current densities of the order of 50 to 100 amperes per sq. ft.

Book on Copper Foundry Practice

Fostoria, Ohio.

"Gentlemen:

We have been referred to you in our search for some authoritative text dealing with copper casting practices. We are interested in data covering the field including crucibles, melting technique, use and composition of deoxidizer, maintenance of purity, pouring temperatures, molds and general casting procedure."

N. C. Co.

Dear Sir:

We recommend our 1941 Casting Manual, which we are sending you, free of charge, and "Non-Ferrous Foundry Practice" by J. Laing and J. T. Rolfe. This book costs $6.00 and is relatively up-to-date, being published in 1940. D. Van Nostrand Co., 250-4th Ave., New York City, are the publishers.

In addition to discussing the foundry practice of copper alloys, the book also discusses foundry practice of aluminum and magnesium alloys.

Drying Zinc and Copper Plated Work

Hamilton, Ont., Can.

"Gentlemen:

We are mechanical zinc and copper plating small parts and we find that both plates are hard to dry without them discoloring badly. We cannot use sawdust to tumble as the work has very small holes in it which become filled with the drying agent.

We have been using a cold water rinse, then whale oil solution and then hot water rinse, and then into a hot oven.

Any suggestion you can offer will be greatly appreciated, as to another form of quick drying without too much expense."

R. P. P. Co.

Dear Sir:

In view of your inability to use a drying agent such as sawdust or corn cob material, we suggest the use of a centrifugal type dryer that also blows in heated air at the same time. In this manner, most of the water is removed by the centrifugal action and the blast of hot air dries any residual water remaining on the work.

We do not recommend the use of whale oil soap as a so-called "water shed" agent because this material is alkaline and may cause the finish to subsequently stain. There are many excellent neutral wetting agents on the market that can be used in the final rinse water to facilitate flow-off of the water. Usually 4 oz. to each 100 gal. of water are sufficient.

(Names of manufacturers of the centrifugal dryers and of wetting agents were furnished the inquirer.)

Patents

Bright Tin Bath

U. S. Pat. 2,271,209. M. Schloetter (Germany), assignor by mesne assignments, of one-half to U. S. Steel Corp. and one-half to Carnegie-Illinois Steel Corp., Jan. 27, 1942. A process of electroplating tin from an aqueous solution containing stannous salts, said salts being predominantly organic sulfonates of tin, an acid and colloidally dispersed aggregates electropositive to said solution said aggregates comprising a dispersed material of the group consisting of the phenolic and cresylic resins, bitumens, wood tars, extract from sulfite lignose with sulfonic acids, and cellulose derivatives, electropositive to said solution and material electronegative to said solution adsorbed on said electropositive charged particles and maintaining a cathode current density upward of 2 amperes per square decimeter. Also a tin deposit having a crystal size approximately the wave length of light with said crystals being all oriented in the same direction.

Example:

Tin as benzene disulfonate	30 g.
Benzene disulfonic acid	90 "
Gelatin	0.8 "
Beech wood tar	0.5 cc.
Water	1,000 "

Example:

Tin as stannous salt	25 g.
Naphthalene disulfonic acid	115 "
Glue	1 "
Benzoin resin	0.8 "
Ethanol	3 cc.
Water	1,000 "

3-6 amp./sq. dm. in still bath, higher in agitated solutions. The presence of inorganic anions or acids is undesirable from the standpoint of brightness but a small amount, such as 4%-5% of stannous sulfate may not be objectionable. Patent states that the brighteners can be used for depositing other metals also.

Coating Sheet Metal

U. S. Pat. 2,278,600. R. J. Wean, assignor to The Wean Engineering Co., Inc., Apr. 7, 1942. In a method of galvanizing sheet steel, the step including passing the base metal through a spelter bath including zinc-iron alloy, the iron of said alloy being of the order of 2% of the bath throughout the greater portion of the depth thereof, and maintaining said metal at all times in the top 40% of the depth of the bath in which the iron content of the bath is materially lower than 2%.

Electroforming

U. S. Pat. 2,282,260. A. J. Spelker, May 5, 1942. A method of producing a tool by electroforming, for marking a surface portion corresponding to a given sunken design of an article.

Corrosion Prevention of Iron and Steel

U. S. Pat. 2,273,234. R. R. Tanner, assignor, by mesne assignments, to Parker Rust Proof Co., Feb. 17, 1942. Production of a protective oxalate coating on iron and steel using an acidified solution of ferric oxalate.

Example:	Oxalic acid	1%-10%
	Ferric salt	1%

Enough oxalic acid should be present to prevent hydrolysis of the ferric oxalate but not enough to produce substantial pickling action.

Silvering Non-Conductors

U. S. Pat. 2,273,613. W. F. Bartoe, assignor to Rohm & Haas Co., Feb. 17, 1942. A process for forming a mirror on an article made of alphamethacrylate resin which comprises treating the surface of said article for a period of time of the order of 12 to 48 hours with a concentrated solution of an alkali hydroxide until the surface is receptive to silver, and then silvering in the usual manner, with a silvering solution and a reducing solution.

Conductive Coating

U. S. Pat. 2,280,135. T. W. H. Ward, Apr. 21, 1942. A conductive coating for glass comprising metal of the group consisting of nickel, tin, bismuth, cadmium, chromium and silver, in the form of finely divided flakes, dispersed in a liquid medium comprising a film forming organic substance and a volatile solvent thereof.

The Polishing of Steel

(*Concluded from page* 308)

the water with some organic compound in order to decrease the current density required for the formation of the polarization film. This would lower power costs and probably give a higher polish.

It is further suggested that work be tried in the plating with copper or other metal and then polishing this second metal rather than the base metal. This surface then would be suitable for bright plating. As for instance, plating steel with 0.0005" of copper, then polishing electrolytically until average of not more than 0.00025" is removed. The resultant surface should be highly polished and suitable for bright nickel plate followed by chromium.

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NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

New Burring Method

The Roberts Rouge Co., Stratford, Conn., have announced a new development in burring of metals, made in cooperation with the Osborn Mfg. Co., Cleveland, Ohio, manufacturers of wire wheels.

The new burring method involves the simple application of a burring compound to a wire wheel. The company claims to have overcome the difficulty in making compounds stick to wire wheels, and it is stated, that enough of their specially prepared cutting abrasive material adheres to the wire ends to give a smooth, clean burring job without any residue remaining in screw slots, crevices and other recesses. At the same time, it is also stated that close dimensional tolerances are preserved, which factor is important when finishing precision work.

Typical wire wheels successfully used for the burring operation are hard, flexible wire brush wheels, 12" in diameter with wire sizes of 0.0104" and 0.005", depending upon the burr or rough places to be removed. The wheel speed is 2400 RPM. In some cases, it is reported, a tampico wheel or cotton or felt buffs may be used. Wire and tampico wheels are claimed to be particularly good on irregular contours or curved places requiring burring.

The new burring process, according to the manufacturer, is much speedier, and more accurate than hand filing and grinding.

Emulsion Type Cleaner

Cowles Detergent Co., 7016 Euclid Ave., Cleveland, Ohio, have announced the development of a new solvent-emulsion type cleaner for cleaning metals, and it is stated that this cleaner is suitable for use on all metals, and it leaves an invisible oil film, which is claimed to be ideal for painting or shop storage.

It is suggested that it be used previous to alkaline cleaning preceding plating, to speed the cleaning operation and to remove oils as well as solid dirt.

The cleaner can be used alone or diluted with water or kerosene.

Descriptive literature on this new product is available upon request.

Down Draft Dust Control System

One of the recent developments of The Kirk & Blum Manufacturing Co., is the down draft system of dust control. A feature is that dust is carried off through ducts constructed under the floor, which saves floor space and does not obstruct working areas. Bench-high gratings, through which air is exhausted, enable operators to conveniently handle castings for sanding, snagging, grinding, polishing and buffing.

The manufacturer states that the machine tool industry, in particular, has found the K & B down draft dust control system to be a decided advantage in its finishing departments. Here it is possible to grind and sand castings within a few feet of precision machinery without the necessity of partitions or curtains. All dust particles are carried down through the gratings as fast as they are released. These surface gratings and under-the-floor ducts help maintain a clear atmosphere. Further information and catalog will be supplied by addressing The Kirk & Blum Manufacturing Co., Spring Grove Ave., Cincinnati, Ohio.

Annealing and Pickling Shell Cases

The Hanson-Van Winkle-Munning Co., Matawan, N. J. have been appointed sole sales representatives in the United States for equipment of the automatic type for annealing and pickling of brass shell cases. The equipment was developed by Curran Bros. Ltd. of Cardiff, Wales, who have built and installed virtually all of the shell processing equipment in England and have recently installed several plants in Canada as well as two plants in the New England States. These installations are for annealing and pickling brass shells, but the manufacturers are also in a position to furnish the proper equipment for processing steel shells.

According to one authority* this type of equipment represents an important change in this field. It should result in the replacement of the old type of pickling or cleaning tanks and rinses by chambers equipped with high-pressure jets or sprays through which articles pass on conveyors of the belt and roller type. It is possible also that automatic pickling of this kind may reduce the necessity of expensive controlled-atmosphere annealing furnaces, because a plain muffle furnace working in conjunction with a spray pickling plant is cheaper to install and therefore, within the reach of users having a limited output. Which of the two methods will be used will need to be decided by the shape, size and quantity of the articles to be treated.

A typical installation includes a pickling chamber placed at the discharge end of a gas-heated muffle furnace so that cold-worked articles, for example, deep-drawn brass cups, can be loaded on conveying mechanism at the mouth of the furnace and need not be touched by hand until they emerge at the other end of the plant, annealed, pickled, washed and warmed so that they dry very quickly. Pickling chambers of this kind are lined with rubber and have a number of zones in each of which the work passes through high-pressure sprays, first of acid and then of hot water, directed upon it from a number of directions from a frame of fine jets. Usually hot sulphuric acid is used for both brass and steel; a strength of about 2½ per cent, and a temperature of about 140°F is recommended by the makers. The acid is heated by steam coils made of acid-resisting alloy placed in a main reservoir which need hold only a fraction of the amount of acid which would be needed to pickle the same amount of work in the same time when the old methods are used. Hydrochloric acid can be used when no heating is employed; a strength of about 17 per cent, given by a 50 per cent dilution of commercial muriatic acid, is recommended. The plant can be used for any metal which can be pickled by either of these acids.

The advantages claimed for this method of pickling over the usual ones are:

1. A considerable saving in the cost of pickling a given quantity of work.
2. A saving in time.
3. More efficient pickling owing to a marked increase in activity given by the mechanical force of the impinging jets.
4. Absence of spray or fumes, which enables the plant to be placed amidst

Professional Directory

C. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
SALT SPRAY TESTING — CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS. Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St. Newark, N. J.

Joseph B. Kushner, Ch.E.
Metal Finishing Consultant
Plating plants streamlined for defense work.
233 W. 26th St., N. Y. C.

All plating solutions analyzed for one dollar each. Reagent solutions for analyzing at reduced prices.
Platers' Laboratory Service
57 Broad St., Elizabeth, N. J.

presses instead of in a distant, ventilated shed, thus saving handling of material and avoiding delay.

5. A marked saving in the quantity of acid used.

Units of the kind described above need not necessarily be made a structural part of an annealing furnace, for the arrangements are such that no acid fumes emerge from either end of the chamber; yet in some instances attachment is most useful.

The present equipment is designed for handling shells of 37 mm or larger. It includes the necessary pumps, filters, annealing furnaces and pickling unit. When installed, the plant will be complete, ready to operate. The average pickling time in the sulphuric acid solution is 4 minutes and in the majority of cases the complete operation can be completed, including annealing, etc., in 100 minutes.

The annealing furnaces required are known as the "Stress Type" for hardening and a "Mouth Furnace" for softening of the mouth as required for such shells.

The information required for laying out a plant consists of production requirements, per hour or per day, the size of the shells, that is 37 mm or larger, and whether the shells to be processed are going to be made of brass or steel.

It is noteworthy that the same type of equipment may be used for annealing and pickling many items other than shells.

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* The Metallurgy of Deep Drawing and Pressing by J. Dudley Jevons (John Wiley).

Manufacturers' Literature

Anodic Cleaning of Steel

Oakite Products, Inc., 22 Thames St., New York, N. Y., have recently published a 4-page bulletin describing their new product called "Oakite Composition No. 90," for reverse current, degreasing and cleaning of steel. The various advantages of the cleaner are outlined and specified uses for the material, particularly in the war industry, are given.

Cleaning of Industrial Floors

The Magnus Chemical Co., Inc., Garwood, N. J., have just issued a 24-page technical bulletin entitled "The Cleaning of Industrial Floors." The bulletin describes the importance of cleaning floors from safety and other factors, and the cleaning of practically every type of floor material used.

Hard Chromium Plating

United Chromium, Inc., 51 E. 42nd St., New York, N. Y., have issued a 16-page data bulletin summarizing the applications where industrial chromium plating saves materials and man-hours in the production and maintenance of metal products. It contains specific examples of how production-rejects and metal working tools are being salvaged; how the service life of tools, gauges, wearing parts, etc., can be greatly increased; how hard-to-get equipment parts and tools are being reclaimed when worn.

(*Continued on page* 320)

Gold

Another SUCCESS!

WAR BOARD BANS RHODIUM FOR PLATING

INTO THE BREACH COMES

ROBINSON'S ASSAYED PLATINUM PLATING SOLUTION

Platinum

Simple to operate—Lower Priced

Excellent DIRECTLY On Silver

Prevents tarnish and corrosion

NOW WE HAVE 2 CHAMPIONS

FOR THE PLATING ROOM

Endorsed by the Most Critical

ROBINSON'S ASSAYED GOLD & PLATINUM PLATING SOLUTIONS

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Simple — Dependable — Economical — Uniform

Research developments that mark a definite step forward in scientific plating. Metal by weight, not by the quart. Add only water.

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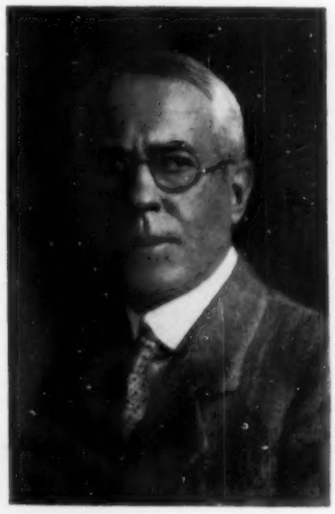
REFINERS & SMELTERS OF GOLD—PLATINUM—SILVER

131 CANAL STREET NEW YORK

"SIXTY-TWO YEARS AT PRECIOUS METALS"

Obituary

Nathan P. Hunter



Nathan P. Hunter, for thirty-six years a salesman for Egyptian Lacquer Mfg. Co., New York, died on May 6 of a heart ailment. Mr. Hunter was born on May 27, 1874 in Mt. Auburn, Ohio, and shortly after his birth, the family moved to Norwalk, Conn.

He was a charter member of the Chicago Branch of the American Electroplaters' Society, and a former president of the Fellowship Club of the A.E.S. His cheerfulness will be remembered by his many friends and customers.

Mr. Hunter is survived by his wife, two daughters, two grandchildren, two brothers and a sister.

CHROMIC ACID

99.75% PURE

With two complete, independent plants at Jersey City and Baltimore, and its own supply of the basic raw material Chrome Ore from company owned and operated mines, Mutual is the world's foremost manufacturer of Chromic Acid.

BICHROMATE OF SODA
BICHROMATE OF POTASH

Mutual Chemical Co of America
270 MADISON AVENUE, NEW YORK

BRING YOUR PROBLEMS TO
FINISHING HEADQUARTERS

McAleer is the source for **all** types of finishing materials. McAleer has laboratory facilities and technicians to solve special problems—develop new compounds.

Headquarters for sanding, rubbing and buffing compounds, tripoli, grease stick, rouge, white finish, emery cake and paste.

Distributors Valencia Pumice
Powdered and Lump

McALEER MANUFACTURING COMPANY
ROCHESTER, MICHIGAN

The bulletin also offers suggestions on how existing plating equipment can be converted to "hard" chromium plating for war production—or how this work can be obtained through competent job plating shops. The bulletin will be sent on request.

Machine Maintenance with Metallizing

A 16-page Bulletin 42A, just published by *Metallizing Engineering Co., Inc.*, Long Island City, N. Y., describes the metallizing process and equipment for its application. The bulletin tells briefly how essential industries are eliminating replacements, and increasing service-life of equipment now difficult to replace, by building up worn diameters with any desired wear, and corrosion-resistant sprayed metal. Also indicates how metallizing is used to rapidly salvage mismachined parts and defective castings in production. Examples are given to show how metallized "inserts" and coatings are helping manufacturers conserve vital metals.

Pickling of Iron and Steel

"Modern Pickling of Iron and Steel" is a new 12-page booklet published by The Enthone Co., 442 Elm St., New Haven, Conn.

This booklet describes the company's Acid Addition Agent, to be used in both cold hydrochloric and hot sulphuric acid pickles. The use of this addition agent is stated to result in faster pickling, reduce attack upon the steel, saving of acid and reduction of fumes. The use of the material for pickling of springs to prevent embrittlement and in electrolytic pickling is described. A special use in hydrochloric acid, for stripping heavy chromium coatings, is also explained.

Plating Conveyor Bulletin

Semi-Automatic Heavy Duty Plating Conveyor. Bulletin SA-101 of the *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., giving illustrations and detailed descriptions of the construction and the improved features in this class of equipment. The bulletin describes the various types of drives, a wide range of heavy duty carriers, methods of agitation or "motion plating" and ventilation; also the operation of these machines in combination with full automatics. The bulletin is profusely illustrated throughout.

Sheet Metal Work

Just off the press is a new Kirk & Blum catalog "Data on Production Facilities". The catalog presents to manufacturers, who must of necessity sub-contract certain sheet metal parts and assemblies, a complete list of machines that comprises the Kirk & Blum facilities for prompt execution of sheet metal, sheet steel, and light plate fabrication. The name and size of each piece of equipment are also listed.

Throughout the catalog are many illustrations of the various sheet metal parts and large assemblies that have been fabricated under contract for many leading national industries.

A copy of this catalog will be sent to those interested by addressing a request to The Kirk & Blum Manufacturing Co., Spring Grove Ave., Cincinnati, Ohio.

Temperature Regulators

Bulletin No. 600 of *Sarco Co., Inc.*, 475 5th Ave., New York, describes and illustrates the company's various temperature regulators for use in controlling temperature of hot water heaters, process tanks, etc. Drawings illustrate constructional details of the regulators.

Technical Publications

Tin Solders

The need for economy in tin makes it necessary to consider where and how the composition of tin solders can be modified with this object. Changes of this kind must be based on a sound knowledge of existing tin solders and their properties. It is therefore of interest that the British Non-Ferrous Metals Research Association is issuing a second edition of its monograph, "Tin Solders". The first edition, written by Mr. S. J. Nightingale, has been thoroughly revised by Dr. O. F. Hudson and brought up to date in the light of investigations carried out in the last 10 years in the Association's laboratories and elsewhere. Important new sections have been added on the creep properties of solders and soldered joints, and the new edition, which will be published immediately, is a book of 118 pp., price 10s. 6d. post free (in the United States $2.75 post free). It may be obtained from the B.N.F.M.R.A., Euston Street, London, N.W.1, or from any bookseller.

Associations and Societies

Los Angeles Branch

Annual Meeting

The eighth annual educational session of Los Angeles Branch, A.E.S., was held at the Los Angeles Breakfast Club on March 21, with an average attendance of 100 at the morning and afternoon business meetings and 231 at the dinner dance in the evening.

In his welcoming address at the opening session at 9:30 a.m., President *Don Bedwell* declared that the branch, after careful consideration of the war situation, had unanimously agreed that "this was no time to turn back" and that the educational session should proceed in accordance with plans mapped before the outbreak of the war.

Emmette R. Holman was chairman of the day. He announced that *J. A. Raskin*, chemical engineer of the Udylite Corp., Detroit, the first programmed speaker, had been delayed enroute to Los Angeles. A paper prepared by Mr. Raskin on "Conservation of Plating Materials" was read by *Frank J. Bruner* of the L. H. Butcher Co., Los Angeles. Illuminated slides were used to illustrate relative solvent losses over varying hour periods, the effect of inhibitors on the action of acid on scale, and the use of inhibitors for saving acid.

WYANDOTTE MK-50

WILL SAVE YOU TIME AND MONEY

WYANDOTTE MK-50 Solvent Detergent is used principally in medium and high pressure mechanical spray washers. It is non-toxic and has absolutely no effect on any ferrous or non-ferrous metal. It is practically neutral and remains so during its life in solution. A valuable feature is its ability to throw off the absorbed oils, greases, etc.

An important use for Wyandotte MK-50 is degreasing metal parts using *water* solution in metal parts power-washing machines. *It is being successfully used for degreasing in preference to the scarcer and more costly chlorinated solvents.*

Here's a typical case:

Cleaning large aluminum alloy castings prior to anodizing.

• These castings have such low tolerances that they are checked with master dies after cleaning to insure no loss of metal during the cleaning operation.

Equipment:
Two-compartment mechanical washer.

1st Compartment:
Temperature—145° F.
Concentration—1 gallon Wyandotte MK-50 to 1000 gallons of water.
Time under operation, approximately 1 minute.

2nd Compartment:
Clear hot-water spray rinse, 145° F.

• Wyandotte Service Representatives are skilled in solving cleaning problems of *all* kinds. They are constantly finding short-cuts and helping to eliminate cleaning bottle-necks. A call for their assistance places you under no obligation.

Wyandotte PRODUCTS
SERVICE REPRESENTATIVES IN 88 CITIES

THE J. B. FORD SALES COMPANY • WYANDOTTE, MICHIGAN

METAL COLORING AND FINISHING

Hugo Krause

Consulting Chemist to Metal Finishing Industry

$5.00

TELLS HOW . . .

—To color all types of metals and alloys
—To prepare metal surfaces for coloring
—To finish colored metals

It is comprehensive and will be of use as a reference and guide book to those engaged in metal coloring in its decorative as well as protective phases. Many of the so-called secret processes of the electroplating art are described in considerable detail with critical comments by the author.

WHAT THIS BOOK CONTAINS

Formulae and Patents
Influence of Alloying on Coloring
Difficulties Encountered
Preparation of Surfaces
Degreasing
Rust Removal
Grinding
Polishing
Cleaning
Lacquering
Waxing
Electrochemical Methods
Dipping
Rubbing and Contacting Methods
Nickel
Copper
Gold
Silver
Zinc
Brass
Bronze
Cadmium
Tin
German Silver
Aluminum
Magnesium
Varnishes
Metal Lacquers
Bronze Powders
Antiquing Imitation
Platinum Finish
Coloring and Protecting Iron
Brass
Zinc
Tin
Silver
Gold
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Green Plating
Chemical Metal Coloring
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Phosphatizing
Rust Prevention

Book Payable In Advance

Metal Finishing, 116 John St., New York

FORGING PRODUCTION LINKS!
THERE is a story behind Cowles Alkaline and Solvent type metal cleaners. Each cleaner has been developed as a solution to a specific metal cleaning problem. War plants and arsenals requiring specialized metal cleaning processes consult with Cowles Laboratory Technicians. As a result, quicker and surer cleaners have been developed.
Capacity production and more, is demanded from our Nation's War Plants. Each link in the vital production chain must be as strong as the others, if we are to reach our production peak.
Examine your chain. Can your metal cleaning, and consequently your entire production program be stepped up?
We invite your inquiries. If there is a way to speed up your metal cleaning, our laboratory technicians will find it. This service is yours for the asking.
USE LIXOL The Solvent Emulsion Type Cleaner
THE VITAL LINK
COWLES CLEANERS
THE COWLES DETERGENT COMPANY
7016 EUCLID AVENUE
Metal Cleaning Department
CLEVELAND, OHIO

CONTROL
SOLUTIONS
&
DEPOSITS

METAL IS TOO DIFFICULT TO OBTAIN TO WASTE IT

Thickness Test Sets to conform with Army—Navy Specification AN-QQ-P-421a for Cadmium and Zinc.

A complete line of Testing Sets for controlling solutions and testing deposits.

Complete laboratory service.

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4720 S. CHRISTIANA AVE.
CHICAGO

Herold J. Kroesche, sales engineer, A. J. Lynch Co., Los Angeles, read a paper entitled "By-Passing Pitfalls of the Plater with the New Vitreous Silver." Explaining how government restrictions on other metals had resulted in a search for a reasonable substitute for restricted metals, using raw materials not limited by priorities, Mr. Kroesche described a new decorative silver deposit plating process in which the silver finish is given a vitreous enamel coating and fired under a ceramic process. The method, Mr. Kroesche declared, does not have as wide an application as nickel or chromium, but, in a limited way, should go far in allowing the manufacturer to produce certain articles of commerce for civilian use.

John C. Bogle, electrical engineer of the Udylite Corp., spoke extemporaneously on "Rectifiers on the Job," emphasizing the increasing use of rectifiers in the metal finishing industry as the war proceeds.

He presented a short history of rectifiers, referred to the trend toward dry disk units in the middle and late 1920's, and concluded with a discussion of the relative value of single units of large size or batteries of smaller units for handling specified jobs.

Mr. Bogle said that three advantages which rectifiers have over generators are: They are immediately available because they are still in stock; they are adaptable to various purposes; and they may be converted to other uses when a change-over becomes necessary.

An informal luncheon was held in the main dining room of the Breakfast Club at 12 noon, with approximately 75 present.

First speaker on the afternoon program was *B. G. Daw*, president, LaSalco, Inc., St. Louis, who discussed "What Happens Inside a Plating Barrel." The main point emphasized by Mr. Daw was the necessity of considering area in a barrel plater. With motion pictures he effectively demonstrated the movement of parts inside a plating barrel. Close-up views showed how small parts are shuffled about in barrels of different size; how the size of the load in the barrel affects the movement of small parts; and how, under some conditions, only the upper outside pieces move as the barrel revolves.

Robert R. Janssen, process engineer of the North American Aircraft Corp., Inglewood, Calif., next read a paper on "Aircraft Electro-Finishing." He described the principal methods employed currently in airplane factories for plating to obtain corrosion prevention. Mentioned were anodizing for aluminum; cadmium plating for steel, brass or bronze; anodizing substitutions; hard chrome plating; after-plating; and selective case hardening of parts.

In his second appearance on the program, Mr. Bogle of the Udylite Corp. led a spirited discussion dealing with "Stray Currents" and how they may be eliminated. The speaker and various members from the audience diagrammed their versions of tank hook-ups by means of which stray currents could be eliminated.

The final paper was presented by *James P. ApRoberts*, technical research engineer of Turco Products, Inc., Los Angeles. Mr.

ApRoberts' subject was "The Relation Between Tap Water and Plating Efficiency."

Out-of-town visitors, in addition to Mr. Bogle and Mr. Daw, included *C. F. Webber* and *Gil Extale* of the General Electric Co., Ontario, Calif.; *Joseph LeVoy*, L. H. Butcher Co., San Francisco; *T. G. Coyle*, United Chromium Co., Detroit; and *John Johnson*, Turco Products, Inc., San Diego.

Twenty manufacturers and distributors of plating materials and equipment sponsored exhibits in the products show which was held in the main auditorium, adjoining the meeting hall.

The annual dinner and dance was held in the main ball room beginning at 8:30 p.m. Reservations for this event totaled 231. A floor show was presented during the course of the dinner and an orchestra was on hand to provide dance music later in the evening.

Marcus Rynkofs served as master-of-ceremonies, assisted by *Erwin Frauenhoff* and *E. Holman*.

A center of interest was the table presided over by Mr. Lamoreaux who was host to a group of relatives whose birthdays occurred a few days before or after the dinner. To mark the occasion, one of the entertainers sang "Happy Birthday to You" at the Lamoreaux' table.

The committee which handled arrangements and direction of the educational session and annual dinner consisted of *M. D. Rynkofs*, chairman; *Don Bedwell, Emmette R. Holman, Frank J. Bunker, Edward Wells, O. Johnson, Stanley Rynkofs, James ApRoberts, Frank Rushton, W. A. Shuler, Bruno Schindler*, and *Erwin Frauenhoff*.

Personals

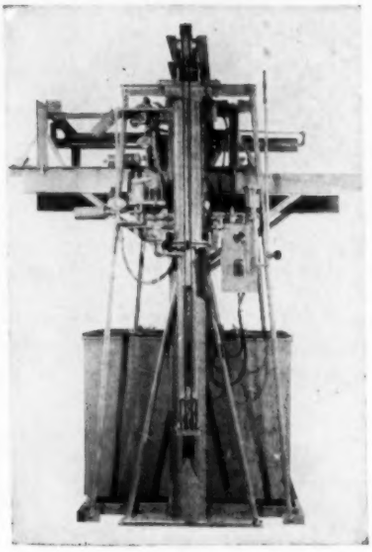
Major John Slezak of Sycamore, Illinois, has been assigned new duties as Chief of the Tank and Combat Vehicles Division of the Chicago Ordnance District, it was announced by Colonel Donald Armstrong, Deputy District Chief. As Chief of the Tank and Combat Vehicles Division, Major Slezak will direct a program which already has run into hundreds of millions of dollars.

Major Slezak is on leave of absence from his position as president of Turner Brass Works, Sycamore, Ill. He joined the staff of the Chicago Ordnance District on January 26, 1942, as Assistant Chief of the Ammunition Division.

His business associations include seven years as an engineer with the Western Electric Company where he became the head of the metal machining methods division. He joined Turner Brass Works as an engineer in 1930. He was promoted to works manager and later became vice president and general manager. In 1939 he was elected president of this concern.

Major Slezak helped to organize the Machine Tool Division of the Army-Navy Munitions Board while on a tour of duty in the Army during 1940.

Crown Pick-up Unit



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A UNIT TYPE TRANSFER CAPABLE OF HANDLING SEVERAL TANKS AT ONE TIME.

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...USE...

FOR A SERIES OF OPERATIONS WHERE THE WORK MUST PASS THROUGH SEVERAL TANKS, AS THE CLEANING AND RINSING OPERATIONS, FOR A SEMI-AUTOMATIC PLATING TANK.

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Some of America's biggest Defense Plants

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McKeon's

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TRADE MARK REG'D

For

Removing Copper

After

Selective Carburizing

Sample and Cooperation FREE

SULPHUR PRODUCTS CO. Greensburg, Pa.

Eliminate
ALL GRINDING in
LOCALIZED HARDENING of STEEL PARTS

In current practice, steel parts which are to be hardened only in certain areas require considerable preparation before heat treating. First the pieces are copper plated. From the plating cycle the parts are trucked to a grinder where the plating is removed from the portions to be hardened. The parts are then trucked to the heat treating furnace.

This procedure can be simplified and the grinding operation entirely eliminated through the use of a specially developed Miccro Supreme Stop-Off Lacquer. In this simplified method, the pieces are coated with Stop-Off Lacquer on the areas to be hardened before they are plated. The lacquer is removed from the plated pieces and they are ready for heat treatment without further preparation.

Miccro Supreme Stop-Off Lacquer is easily applied and removed. Its use requires no special skill or equipment. The saving in both time and money from the elimination of the grinding and the reduction of the handling between the plating cycle and the furnace is obvious. More important right now, vital grinding equipment is freed for other production uses.

Write today for complete information on the use of Miccro Supreme Stop-Off Lacquer for localized hardening of steel parts.

Miccro Supreme
STOP-OFF LACQUERS
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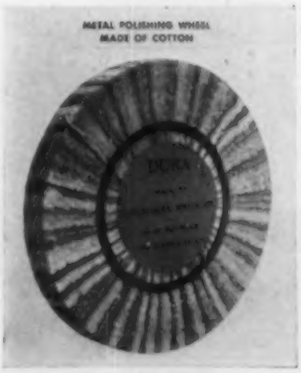
MICCROLITE
•
MICCROFLEX
Developed and Manufactured by Experienced Platers

MICHIGAN CHROME & CHEMICAL CO.
348 EAST JEFFERSON • DETROIT, MICHIGAN

GRINDING—POLISHING WHEELS
Leather—Canvas—Cotton—Wool



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Low Cost
Immediate Deliveries

ARROW DURA WHEEL, Inc.
29-26 40th Road
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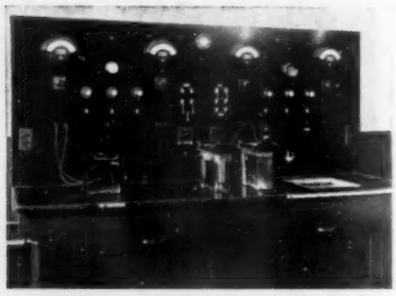
Business Items

Hanson-Van Winkle-Munning Co. Builds Improved Plating Laboratory

In order to provide facilities for the greatly increased volume of research and experimental work necessary under present conditions, the plating laboratories of the Hanson-Van Winkle-Munning Co., Matawan, N. J., have been completely reconditioned and expanded.

The external appearance of the laboratory has been improved by joining two buildings and constructing a new, decorative entrance. All laboratory rooms are now accessible from a central hallway. Three new offices have been constructed, as well as a library. Stairways now connect the laboratory to the main office so that it is not necessary for visitors or persons within the plant to go outdoors.

A new solution preparation room has been provided for analytical solutions for the Company's own use, and also for those which are sold to customers. Between the solution preparation room and the analytical laboratory, an experimental electroplating room has been built and a modern and complete electroplating control board installed. This board is used for making bent cathode tests on plating solutions, for experimental electroplating tests, and for the examination of raw materials and supplies used in electroplating processes.



Electroplating control board in the Hanson-Van Winkle-Munning Laboratories for experimental electroplating tests, examinations of raw materials and supplies in electroplating processes.

This control board has six places for work, with coded plugs and jacks to facilitate rapid setting up and tearing down of experimental plating units. The plug-in feature is a valuable aid to ease in handling, setting up and taking down experimental equipment.

The board is divided into two parts with three places in each part. Each set of three places is served by one ammeter and one voltmeter, with selector switches provided to enable the operator to obtain the desired voltage and amperage at each place. A field rheostat is available for the control of the voltage at the generator. In addition, carbon pile rheostats have been placed in series with each set of outlets for close control of the current.

One side of the board with its three places is used for work at room temperature and low current density. The other side is used for the higher current density range, at higher temperatures, thermostatically controlled, in a stainless steel tank.

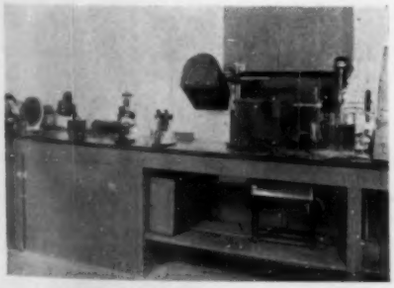
Special glass, laboratory size, plating bath containers are provided of shape and proportions to simulate commercial conditions, with the proper relationship of anode-to-cathode area. A built-in timing device with a pilot light and buzzer are included for timed experiments. The thermostatic bath is electrically heated and agitated.

Compressed air is available at the panel, fitted with air filter and air regulator. Where mechanical agitation is required, as for example in cyanide solutions, air and electric motors are used, with proper speed control.

Sources of current are a generator and batteries. Either source can be thrown in by a double-throw switch. Another switch is provided for charging the battery by the generator.

Research room in the Hanson-Van Winkle-Munning Laboratories with new pumps, tanks and heating facilities.

Research facilities have been expanded by providing more space and also by installing new equipment. The instrument room is used for both research work and routine control. Besides the metallographic equipment, such as specimen mounting presses, microscopes and other physical testing equipment, the installation includes an optical bench, special photographic equipment and a stereoscope for microscopic examinations. A dark room is available for processing plates and films. Adjoining the instrument room, a research laboratory has been provided for the study of alkalies, inhibitors, fluxes and related products.



Instrument room in the Hanson-Van Winkle-Munning Laboratories with optical bench, microscopes and photographic equipment.

HARD CHROMIUM PLATING

is essential in the

WAR EFFORT

ZIALITE ADDITION AGENTS

are doing their share in giving the hardest, finest grained chrome plate for use in submarines and many other fields.

Whether or not you are licensed for chrome plating, you owe it to yourselves and Uncle Sam to use these ADDITION AGENTS which give:

1. **Finer grain structure**
2. **More durable plate**
3. **Smoother heavy deposits**
4. **Greater throwing power**
5. **Less sensitivity to sulphate ratio.**

If you are interested, write us today and send a sample of your present bath to see if it is suitable for conversion to this improved formula.

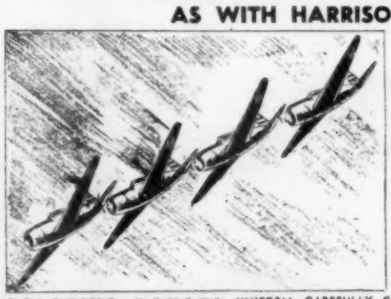
ZIALITE CORPORATION

143 Exchange Street

Worcester, Mass.

UNPARALLELED UNIFORMITY

AS WITH HARRISON'S 4A PRODUCTS



FOR GETTING MORE WORK FROM YOUR GRAIN USE

4A CEMENT and THINNER

A Substitute For Glue

NO WORRY ABOUT GLUE SHORTAGE WITH 4A CEMENT AND THINNER. Polishing wheels are free cutting, long lasting and economical when set up with 4A Cement.

COLORING ROUGES UNIFORM, CAREFULLY GRADED RAW MATERIALS, EXPERTLY COMPOUNDED BY HARRISON'S TECHNICIANS, INSURE ROUGES THAT GIVE HIGH LUSTER AND FAULTLESS FINISHES.

POLISHING COMPOUNDS 4A symbolizes those four features which you require for high speed polishing, mirror finishing of all kinds of steel, including stainless steel, carbon steels and hard-to-buff alloys. Use it on any kind of a wheel, soft, medium or hard.

Tell us your problem and samples of compounds, rouges or cement will be sent.

We will be pleased to recommend proper methods.

"AMPLE STOCKS TO TAKE CARE OF OUR TRADE"

4A **HARRISON and COMPANY**

Haverhill, Mass.

PLATERS and finishers of various metals find that Metso Cleaners help to stretch production time. The Metso balanced alkaline cleaners cut through the grease and oil on metal, leaving a chemically clean surface. In one steel plant thorough cleaning is obtained with Metso in 2½ seconds.

There's no time wasted in re-washing because of incomplete cleaning. Metal parts are quickly ready for further processing.

Metal Cleaners are adaptable for all types of metal cleaning—electrolytic, soaker, spray. Details of application for your cleaning operations sent on request.

PHILADELPHIA QUARTZ COMPANY

EST. 1831

Gen'l Offices: 125 S. Third St., Phila., Pa. Chicago Sales Office: 205 W. Wacker Dr.
Sodium Metasilicate U. S. Pat. 1898707. Sodium Sesquisilicate U. S. Pat. 1948730, U. S. Pat. 2145749

METSO CLEANERS

The polishing room has been rebuilt and new equipment installed, including a special heavy duty variable speed Hanson-Van Winkle-Munning Type MI lathe and other accessory equipment. A small bench lathe is used for preparing specimens and for polishing of small articles.

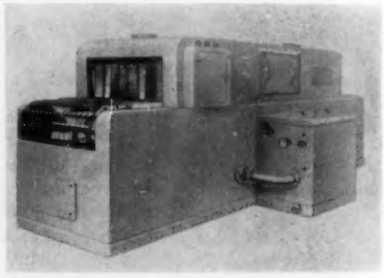
Adjoining the polishing room is the testing room and on the other side of the testing room is spray equipment for lacquering samples. A new exhaust system has been installed.

A large research room where semi-commercial plating tests can be made, has been provided on the second floor. New pumps, tanks, heating devices and controls have been installed.

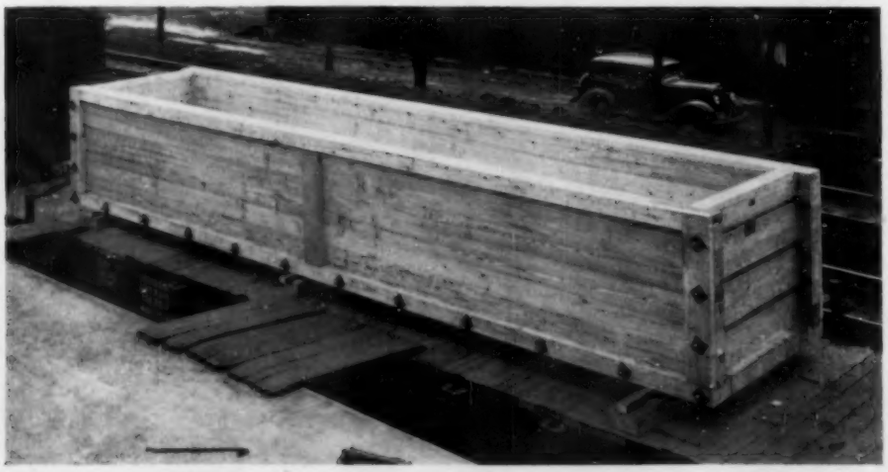
Magnus Chemical Company Organizes Machine Division

The organization of a Machine Division for the manufacture of mechanical metal washing machines, pickling machines, driers, ovens and burnishing equipment, is announced by the Magnus Chemical Company, Inc., Garwood, N. J. The Magnus organization is well-known in the industrial field as a manufacturer of cleaning materials, industrial soaps, metallic soaps, sulfonated oils, emulsifying agents and metal working lubricants.

The new Machine Division will be under the direction of *Marcel Zinty*, former general manager of the Magnus European factory. Mr. Zinty is a mechanical engineer with a long and broad experience in the design, construction and installation of all such types of machines and equipment. His experience embraces a long list of notable installations.



Typical mechanical washing machine made by Magnus Chemical Co.



We can give excellent service on all types of

WOOD TANKS

The shortage of metals has increased the demand for wood tanks for plating and pickling service. We can give excellent service on all types of tanks. Send us your inquiries.

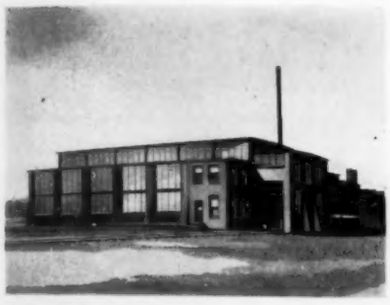
★

KALAMAZOO TANK & SILO CO.
KALAMAZOO, MICHIGAN

A staff of experienced draftsmen and metal fabricators have been assembled, and are now at work on the manufacture of a number of machines for important war plant installations. A complete engineering service is offered, covering everything from the original problem through finished installation to practical operation.

Considerable attention is being given to the development and manufacture of machines for use in connection with the company's "Emulso-Dip" and "Emulso-Spray" processes. Such machines adequately meet all the requirements of high-speed production and the need for saving time and labor, as well as cost.

The Magnus sales organization, comprising 75 special industrial service representatives located from coast to coast, will serve as a distribution force, acquainting industrial manufacturers with facilities of the Machine Division on this equipment, its uses and applications.



New plant of the Chamberlain Engineering Ltd., a unit of the United States Stoneware Co.

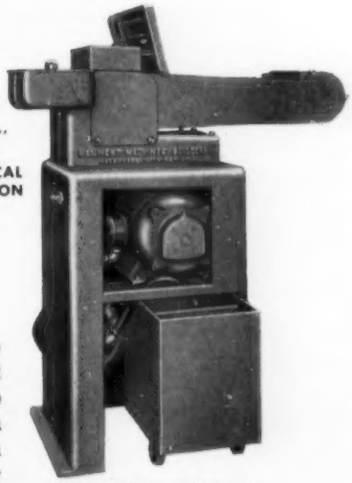
The Chamberlain Engineering Ltd., a unit of the *United States Stoneware Co.*, Akron, Ohio, have just purchased a 10-acre group of buildings at Ravenna, Ohio. The property consists of six buildings, with 50,000 sq. ft. of floor space.

Hammond's NEW "600" DRI-N-WET BELT GRINDER

FASTER • MORE ECONOMICAL • GREATER FLEXIBILITY

Speed and Precision in operation bid to make this new "600" Dri-N-Wet Belt Grinder your greatest aid in "Beating that Delivery Promise."

"600" IN VERTICAL POSITION



"600" FLOOR MODEL IN HORIZONTAL POSITION DOORS REMOVED

Most operations on the "600" can be done free hand, affording great savings in fixture expense and set-up time. It's practically universal in scope of materials it will handle. Can be adjusted for operation in either vertical or horizontal position.

WRITE FOR BULLETIN GP-7.

Hammond of Kalamazoo

HAMMOND MACHINERY BUILDERS, INC.

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Attend the Annual Convention

AMERICAN ELECTROPLATERS SOCIETY

Pantlind Hotel, Grand Rapids, Mich. -:- June 8-9-10

For Complete Information on Program
See Special Section Pages 8-15

You Do Not Have to Be a Member to Attend

DO YOU HAVE A PROBLEM OF DEBURRING OR GRINDING AND POLISHING PRECISION PARTS?

Regardless of size or shape, Lupomatic has a way of handling your particular job. We are equipped with a Laboratory to work out your problem free of charge. We place our Engineering Dept. at your service.

Write us today for full details.

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4510 Bullard Ave., New York, N. Y.

BRASS SHEET

Bronze and Gilding

Processed For Difficult Drawing Bright Finishes

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Offices:
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Truly—Three Great Finishes!!

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For over a quarter of a century building and installing portable sherardizing furnaces and equipment; metal finishing and plating. We invite your inquiry.

THE NATIONAL SHERARDIZING & MACHINE CO.

Office & Factory Hartford, Conn.
Foreign Representatives—Oliver Bros., Inc., 417 Canal St., N. Y. City

Much new equipment has been installed and the buildings have been re-modeled to house various departments to manufacture synthetic resins, corrosion resisting linings, protective paints and coatings, as well as for metal and alloy fabrication. The manufacture of "Tygon" heavy duty tank linings, tubing, gaskets and corrosion resisting paints will be transferred from Tallmadge, Ohio. These new facilities will enable the handling and lining of full sized tank cars and any construction that can be transported on railroad flat cars.

Name of DuPont's R. & H. Chemicals Dept. Changed to Electrochemicals Dept.

The change in name to Electrochemicals Department for one of the manufacturing units most basic in the production of chemicals for peace and wartime uses has just been announced by E. I. du Pont de Nemours & Company.

This group of activities was originally known as The R. & H. Chemicals Department. The change is effective June 1. The new name was chosen because it describes the type of products created by this department without being broad enough to encroach upon the activities of the nine other operating departments of the company.

Electrochemicals Department emphasizes chemicals rather than processes and covers all chemicals which are derived, directly or indirectly, from electrochemical reactions. These are the type of chemicals which constitute the big bulk of this department's manufacturing activity, it being a leading factor in the field of electrochemicals and specialized chemicals used in electroplating, metal cleaning, bleaching, refrigeration and ceramics.

The original name arose from the fact that the department was created after the acquisition by Du Pont in 1930 of The Roessler and Hasslacher Chemical Company.

Subsequently the company was dissolved and its assets and business were consolidated with the parent organization into The R. & H. Chemicals Department.

Under that name the department has been a leading producer of chemicals made by electrolytic processes. At its largest plant sodium and chlorine are produced electrolytically.

Detroit Rex Products Company Opens New Connecticut Office

In line with its recently expanded service policy in the metal cleaning industries, the *Detroit Rex Products Company*, Detroit, Mich., announce the opening of a New England branch office at 8 West Main Street, Meriden, Connecticut, telephone Meriden 688.

PLATERS and POLISHERS DATA BOOK

Chemical Engineering Data, Useful Tables, Instructions, How to clean Easier, Quicker, Less operations, No pealed plate, no rejects.

Send for FREE copy today

Puritan Mfg. Co., Waterbury, Conn.

Originators and Manufacturers of

WONDERBAR, *Pre-Saponified* BUFFING, POLISHING COMPOUND

HECCO BRAND EMERY

Made from the highest quality selected ores obtainable in this country and in the same careful and thorough manner as imported emeries.

These rough-surfaced solid-shaped grains hold unusually well in the glue.

Write for full details.

HAMILTON

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OXY-DYZ-ENE

HIGHEST STRENGTH
OXIDIZING AGENTS
POSSIBLE TO PRODUCE

Sold in LUMP and LIQUID FORMS By Leading Plater Supply Houses

Manufactured For 66 Years By

KREMBS & COMPANY
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BUFFS, CLEANERS

Buffing Compositions
Nickel Anodes
Chemicals and General Supplies

JACOB HAY COMPANY

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For a real good polishing job use

KEYSTONE EMERY

Write for Sample

KEYSTONE EMERY MILLS, 4318 Paul St., Phila., Pa.

WORLD'S FINEST PRE-FINISHED METALS • SHEETS & COILS

NICKEL, CHROMIUM, BRASS AND COPPER FINISHES

AMERICAN NICKELOID COMPANY

6 SECOND ST. PERU, ILLINOIS

VULCAN SODIUM STANNATE

Manufactured by

THE VULCAN DETINNING CO.
SEWAREN, N. J.

Under Patents Nos. 1,575,217 and 1,708,392

FOR TIN ELECTROPLATING

SALES AGENT

The R. & H. Chemicals Dep't, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

CHROMIUM PLATING
SCREWS—RIVETS—
WASHERS
SMALL PARTS, ETC.

THE CHROMIUM PROCESS CO.
Shelton, Conn.

H-VW-M Adds to Plant

Hanson-Van Winkle-Munning Co., Matawan, N. J., manufacturers of electroplating equipment and supplies, are building an addition to their Electrical Department, an extension to the Crane Building, 80′ x 60′, in order to improve the storage and loading facilities for large electrical and mechanical equipment used in war production installations. This extension has been necessitated by the increased production demanded by the war program under which the Electrical Department has gone on a 7-day, 24-hour, 168-hour per week basis.

G. B. Hogaboom, Jr. & Co., have announced the removal of their laboratory from 352 Mulberry St., Newark, N. J., to 44 E. Kinney St., Newark. The company has taken over a two-story building to house the laboratory and various scientific equipment as well as for office purposes.

Wheelco Instruments Co., Chicago, has announced appointment of four new district representatives. *Pasol Engineering Company*, has been named Iowa and Nebraska representative, with *V. E. Lindquist* in charge of the Iowa office at Des Moines, and *I. I. Solzman* heading the Nebraska office in Omaha. *Fitzgerald, Inc.*, Wichita, has been assigned the Kansas territory, with *Bloyce Fitzgerald* in charge of instrument sales. *Charles A. Drum*, Houston, has been named Texas district manager.

Magnus Chemical Co., Inc., Garwood, N. J., announces two new appointments to its sales and service staff—*William D. West* as sales representative in western South Carolina with headquarters in Greenville, S. C., and *Edwin M. Tait* as sales representative covering Minnesota and South Dakota with headquarters at Minneapolis, Minn.

UNITED LABORATORIES

of Linden, N. J.

Wish to announce a complete line of Greaseless Compound, Emery Pastes, Stainless Steel Compounds, Lime Finishes, Rouges and Tripolis.

A few territories are open for jobbers and manufacturers' agents. United's Research Laboratories are at your disposal.

RIBBON ZINC
For stamping and drawing

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For fuse elements

ZINC WIRE

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Waterbury, Conn.

PERMAG Cleaning Compounds

Save Time and Reduce Labor Costs in Plants Producing War Materials

Brass, steel aluminum, aluminum alloys—all are used in manufacturing war necessities, and require guaranteed cleaning compounds that are rapid and thorough in action and absolutely dependable for every job. PERMAG stands the hardest tests and meets every demand of today. Glad to send you details.

If you've a difficult cleaning problem, we'll help you solve it. Write or 'phone. No obligation for interviews.

Manufacturers of Specialized Scientific Cleaning Compounds for Industrial Purposes.

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Representatives from Coast to Coast. Warehouses in principal cities of U. S. In Canada: Canadian Permag Products, Ltd., Montreal-Toronto.

Main Office: 50 Court St., Brooklyn, N. Y.

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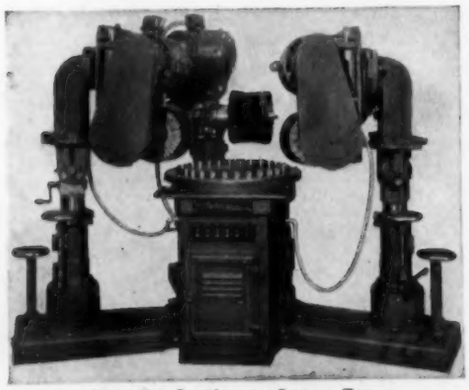
•AUTOMATICALLY

• *Today's*
Efficient Method of Volume
POLISHING & BUFFING



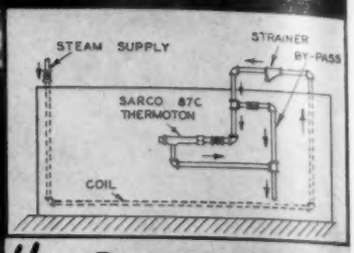
No. 424 Continuous Rotary Type

•AUTOMATIC POLISHING & BUFFING MACHINES

Packer-Matic

THE PACKER MACHINE CO., MERIDEN, CONN., U. S. A.

SARCO THERMOTON



the 2 in 1 TRAP
CONTROL *for Tanks*

The Sarco Thermoton is both a steam trap and a temperature control, and obviously quite inexpensive compared with other methods that might be used.

The illustrations show the Thermoton applied to a cleaning tank and to a tank for heating chocolate. A large manufacturer of plating equipment says, "The Thermoton is ideal because it gives close enough regulation at low cost and on the sulphuric acid tank it is unnecessary to use materials that will resist corrosion." Catalog No. 550. 110

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SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

ROBERTS BUFFING COMPOUNDS ASSURE

The Best Quality, Correct and Uniformly controlled manufacturing, Fair Price Policy, and Special Formulas for Individual Demands.

WE PRODUCE

ROUGES (Iron Oxides) (Quick wash)	All types
TRIPOLI	Numerous grades
EMERY PASTE	All size grains
COMPOUNDS	For every metal
GREASE STICKS	For better efficiency
LIME COMPOUNDS	Many formulas

— Let us send you some free samples —

The ROBERTS ROUGE COMPANY
STRATFORD CONNECTICUT

CUT DOWN REJECTS WITH

ORVUS

IN YOUR METAL CLEANING BATHS
This sulfated fatty alcohol Cleansing Agent is EFFECTIVE

—as a surface tension lowering agent
—as an emulsifier
—in dispersing lime soaps which might cause poor plating results if permitted to deposit on the metal

Write for further information about Orvus to
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A Complete Line of Requirements for the Electroplating Industry

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MUNNING & MUNNING, Inc.
Manufacturers of Electroplating, Buffing, Polishing Apparatus and Supplies.
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Special and Standard Sizes
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ARMITAGE 6766

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Sheets—Rolls

Phosphor Bronze, Bronze Gilding Metal
Low Brass and Special Alloys

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